Silentwriter™ LC 850

Technical Reference Guide

NEC

NEC Information Systems, Inc.

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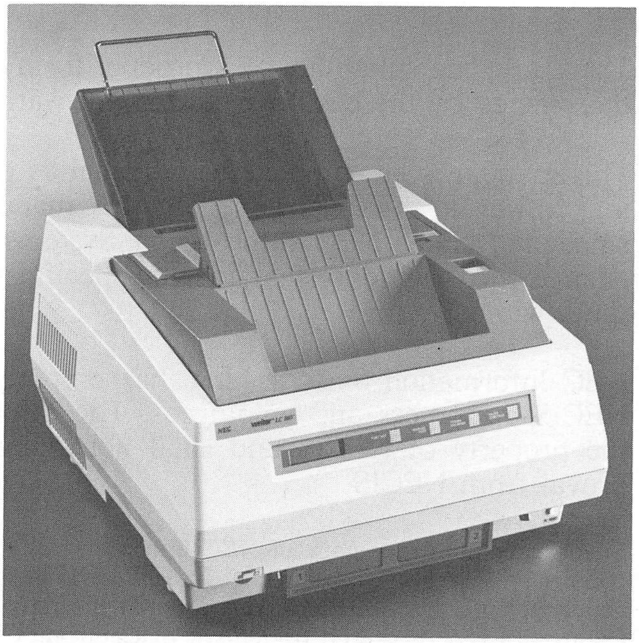

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FEDERAL COMMUNICATIONS COMMISSION RADIO FREQUENCY INTERFERENCE STATEMENT

This unit has been type–tested and found to comply with the limits for a Class B computing device in accordance with the specifications for Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation.

Manufacturer's Instructions and User's Responsibility to Prevent Radio Frequency Interference

Manufacturer's Instructions

The user must observe the following precautions in installing and operating this device:

1. Operate the equipment in strict accordance with the manufacturer's instructions for the model.
2. Plug the unit into a properly grounded wall outlet and use the power cord supplied with the unit, unmodified.
3. Always operate the unit with the factory–installed cover on the unit.
4. Make no modification to the equipment which would affect its meeting the specified limits of the Rules.
5. Maintain the equipment in a satisfactory state of repair.
6. Use a shielded and properly grounded I/O cable to ensure compliance of this unit to the specified limits of the Rules.

User's Responsibility

The user is ultimately responsible for correcting problems that arise from harmful radio–frequency emissions from equipment under his control. If this equipment does cause interference to radio or television reception (which can be determined by turning the equipment off and on), the user is encouraged to try to correct the interference by one of the following measures. All of these responsibilities and any others not mentioned are exclusively at the expense of the user.

1. Change in orientation of the receiving device antenna.
2. Change in orientation of the equipment.

3. Change in location of equipment.
4. Change in equipment power source.

If these attempts are unsuccessful, install one or all of the following devices:

1. Line isolation transformers
2. Line filters
3. Electro–magnetic shielding

If necessary, the user should consult the dealer, NEC, or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission to be helpful: "How to Identify and Resolve Radio–TV Interference Problems." This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 004–000–00345–4.

NOTE

The operator of a computing device may be required to stop operating his device upon finding that the device is causing harmful interference and it is in the public interest to stop operation until the interference problem has been corrected.

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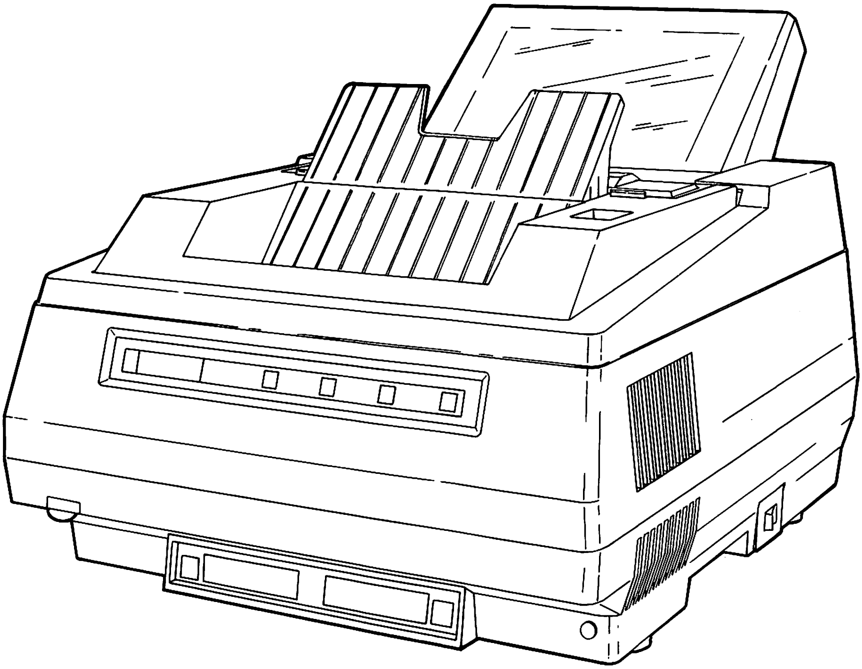
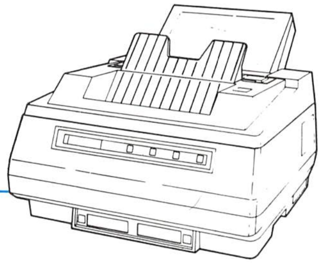
Preface

This guide provides programming and hardware interface information for your Silentwriter™ LC 850 desktop printer. You should be thoroughly familiar with the *Silentwriter LC 800 Series User's Guide* (document #819-150323-000) before reading this guide.

For additional information or assistance, contact your NEC dealer.





Section 1

Switch Settings

The LC 850 has three banks of switches, SW1, SW2, and SW3, located at the rear of the printer. Within each bank are ten switches. In addition, the mechanical control assembly board (G9WPM) inside the printer contains two sets of switches for print position adjustment and language character sets. These switches are read by the printer at power–on, and their functions can be changed by the operator or by software commands.

FACTORY SETTINGS

Figures 1–1 through 1–3 show SW1, SW2, and SW3 factory switch settings in black and give a quick reference to switch functions.

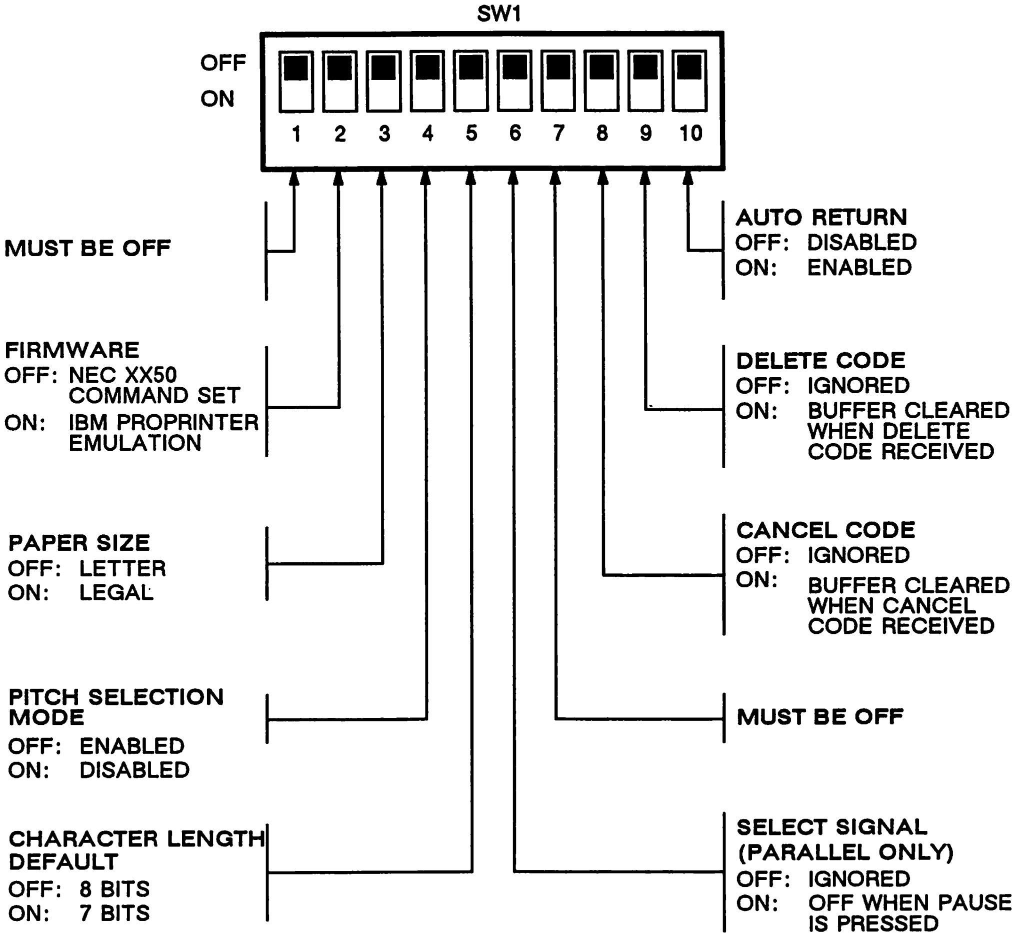
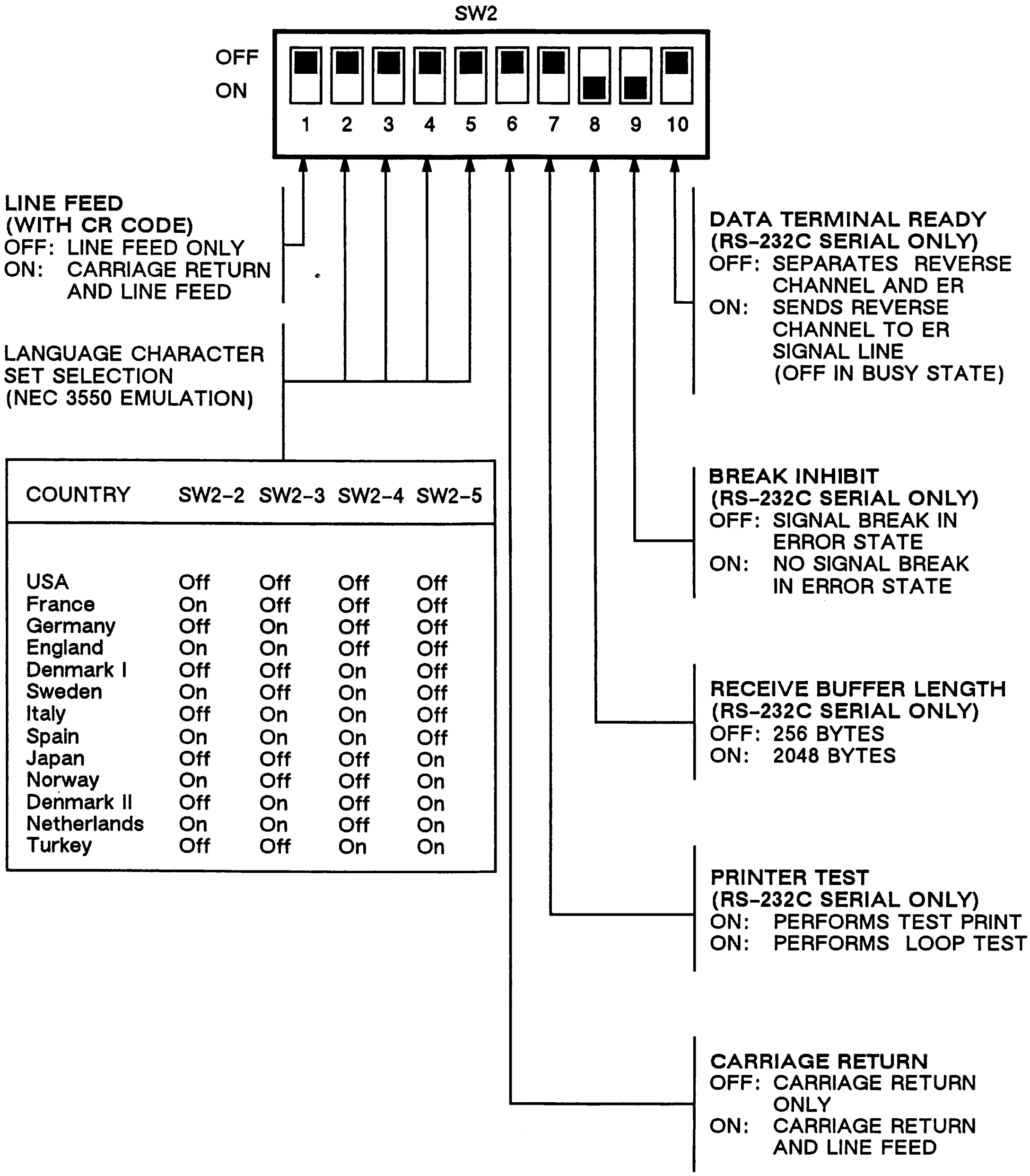


Figure 1-1 SW1 Switch Settings



LINE FEED (WITH CR CODE)
OFF: LINE FEED ONLY
ON: CARRIAGE RETURN AND LINE FEED

LANGUAGE CHARACTER SET SELECTION (NEC 3550 EMULATION)

COUNTRY	SW2-2	SW2-3	SW2-4	SW2-5
USA	Off	Off	Off	Off
France	On	Off	Off	Off
Germany	Off	On	Off	Off
England	On	On	Off	Off
Denmark I	Off	Off	On	Off
Sweden	On	Off	On	Off
Italy	Off	On	On	Off
Spain	On	On	On	Off
Japan	Off	Off	Off	On
Norway	On	Off	Off	On
Denmark II	Off	On	Off	On
Netherlands	On	On	Off	On
Turkey	Off	Off	On	On

DATA TERMINAL READY (RS-232C SERIAL ONLY)
OFF: SEPARATES REVERSE CHANNEL AND ER
ON: SENDS REVERSE CHANNEL TO ER SIGNAL LINE (OFF IN BUSY STATE)

BREAK INHIBIT (RS-232C SERIAL ONLY)
OFF: SIGNAL BREAK IN ERROR STATE
ON: NO SIGNAL BREAK IN ERROR STATE

RECEIVE BUFFER LENGTH (RS-232C SERIAL ONLY)
OFF: 256 BYTES
ON: 2048 BYTES

PRINTER TEST (RS-232C SERIAL ONLY)
ON: PERFORMS TEST PRINT
ON: PERFORMS LOOP TEST

CARRIAGE RETURN
OFF: CARRIAGE RETURN ONLY
ON: CARRIAGE RETURN AND LINE FEED

Figure 1–2 SW2 Switch Settings

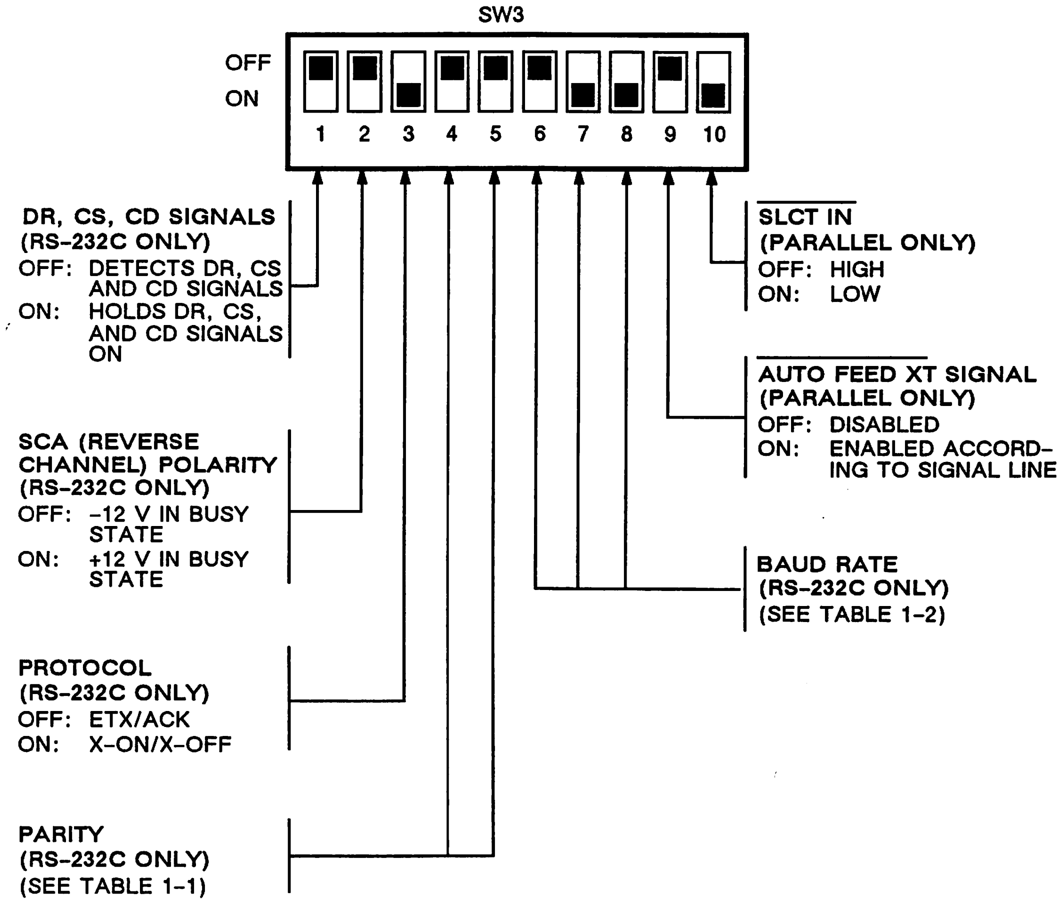

SW3
OFF
ON
1
2
3
4
5
6
7
8
9
10
DR, CS, CD SIGNALS (RS-232C ONLY)
OFF: DETECTS DR, CS AND CD SIGNALS
ON: HOLDS DR, CS, AND CD SIGNALS ON
SCA (REVERSE CHANNEL) POLARITY (RS-232C ONLY)
OFF: -12 V IN BUSY STATE
ON: +12 V IN BUSY STATE
PROTOCOL (RS-232C ONLY)
OFF: ETX/ACK
ON: X-ON/X-OFF
PARITY (RS-232C ONLY) (SEE TABLE 1-1)
SLCT IN (PARALLEL ONLY)
OFF: HIGH
ON: LOW
AUTO FEED XT SIGNAL (PARALLEL ONLY)
OFF: DISABLED
ON: ENABLED ACCORDING TO SIGNAL LINE
BAUD RATE (RS-232C ONLY) (SEE TABLE 1-2)

Figure 1–3 SW3 Switch Settings

Switches 3–4 and 3–5 can be set to vary the parity. Table 1–1 lists possible settings and corresponding parity.

Table 1–1 Parity Switch Settings

SW3–4	SW3–5	SENDING	RECEIVING
X*	Off	Marking State	No Parity Check
Off	On	Adding Odd Parity	Odd Parity Check
On	On	Adding Even Parity	Even Parity Check

*Either on or off.

Table 1–2 gives the baud rates as set by switches 3–6, 3–7, and 3–8.

Table 1–2 Baud Rate Switch Settings

BAUD RATE (BITS PER SECOND)	SW3–6	SW3–7	SW3–8
150	Off	Off	Off
300	On	Off	Off
600	Off	On	Off
1,200	On	On	Off
2,400	Off	Off	On
4,800	On	Off	On
9,600	Off	On	On
19,200	On	On	On

RECEIVE BUFFER SWITCH SETTINGS

When switch 2–8 is on, the receive buffer has a capacity of 2048 characters. When switch 2–8 is off, the receive buffer has a capacity of 256 characters.

The following control signals are used to protect the receive buffer from overflowing.

Reverse Channel (SCA)

The SCA signal is necessary for data transmission to the host CPU. Switch 3–2 determines the active polarity.

SW3–2 Off = Active high (+3 V to +12 V)
SW3–2 On = Active low (–3 V to –12 V)

When SCA is on, the amount of data in the receive buffer is less than 64 bytes.

When SCA is off, the amount of data in the receive buffer is more than 224 bytes (SW2–8 is off) or 2016 bytes (SW2–8 is on).

The SCA signal also goes off under the following conditions:

- error or alarm
- initializing mode
- buffer overflow
- deselect status.

Line Protocol

The two protocols, ETX/ACK and X–ON/X–OFF, are switch selectable.

ETX/ACK

When switch 3–3 is off, the ETX/ACK protocol is selected.

When the printer receives an ETX code, data in the receive buffer is transmitted to the page buffer. Then the printer sends the ACK code to the host CPU. After the host CPU receives the ACK code, data is sent to the receive buffer.

X-ON/X-OFF

When switch 3-3 is on, X-ON/X-OFF protocol is selected.

X-OFF	When data in the receive buffer contains more than 224 bytes or 2016 bytes, the printer sends a DC3 code to signal the host CPU to stop sending data, and an error occurs.
X-ON	When data in the receive buffer totals less than 64 bytes, the printer sends a DC1 code to signal the host CPU to start sending data again.

G9WPM BOARD SWITCH SETTINGS

Switch SW1 on the G9WPM board regulates print position adjustment, and switch SW2 selects the stored language character sets for the front panel display. To access the board, remove the middle and rear covers from the printer. The mechanical control assembly board is closest to the top of the printer.

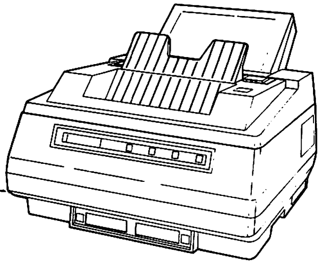
Tables 1-3 and 1-4 describe the switch settings and functions.

Table 1–3 Mechanical Control Assembly Board (G9WPM) SW1

FUNCTION	SWITCHES		ADJUSTMENT	
Adjustment for horizontal print position	SW1–1	SW1–2		
	OFF	OFF	Leftmost position	
	ON	OFF	10 dots (0.8 mm) to the right	
	OFF	ON	20 dots (1.7 mm) to the right	
	ON	ON	32 dots (2.7 mm) to the right	
Adjustment for vertical print position	SW1–3	SW1–4		
	OFF	OFF	Uppermost position	
	ON	OFF	10 dots (0.8 mm) downward	
	OFF	ON	20 dots (1.7 mm) downward	
	ON	ON	32 dots (2.7 mm) downward	
Adjustment for print head LED lighting time	SW1–5	SW1–6		
	OFF	OFF	140 µs	Factory adjusted
	ON	OFF	200 µs	
	OFF	ON	280 µs	
	ON	ON	400 µs	
	SW1–7			
	Must be off			
	SW1–8			
	Must be off			

Table 1–4 Mechanical Control Assembly Board (G9WPM) SW2

LANGUAGE CHARACTER SET	SW2–1	SW2–2	SW2–3	SW2–4
English	OFF	OFF	OFF	OFF
French	OFF	ON	OFF	OFF
German	OFF	OFF	ON	OFF



Section 2

Parallel Interface

The printer has switch-selectable parallel and serial interfaces. This section provides signal and control lines information, timing charts, and logic elements for the parallel interface.

LINES

Figure 2-1 shows signal and control lines across the printer's parallel interface.

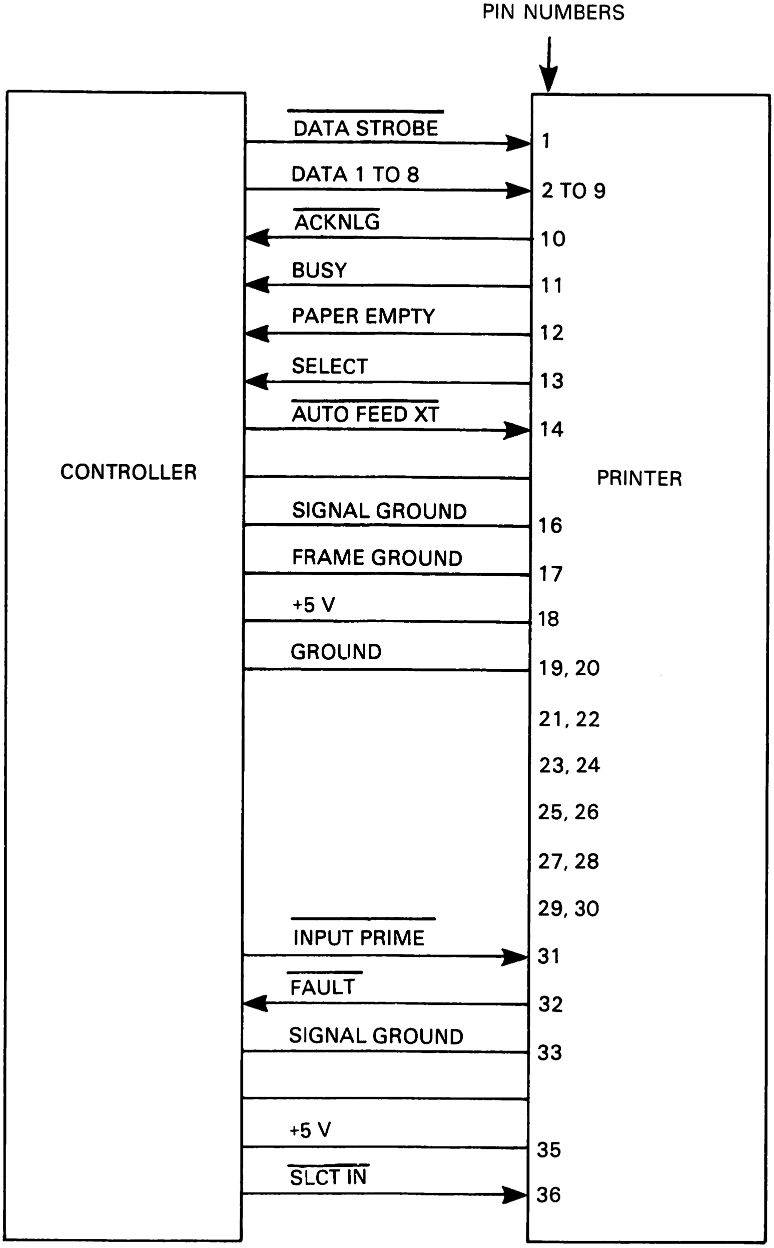


Figure 2–1 Parallel Interface Lines Diagram

Figure 2–2 shows the arrangement of the interface connector pins.

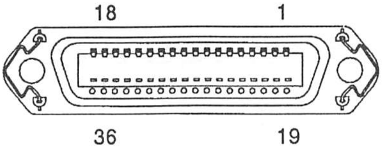


Figure 2–2 Arrangement of Interface Connector Pins

Table 2–1 describes the signal lines and pin assignments for the parallel interface.

Table 2–1 Parallel Interface Lines

SIGNAL PIN	RETURN PIN	SIGNAL	DIRECTION	DESCRIPTION
1	19	$\overline{\text{Data Strobe}}$	To printer	Strobes a data byte to the printer. The minimum pulse width is 0.5 μs.
2	20	Data 1	To printer	Data lines 1 to 8 transmit ASCII code. The lines are high (true) at logic 1 and low (false) at logic 0.
3	21	Data 2		
4	22	Data 3		
5	23	Data 4		
6	24	Data 5		
7	25	Data 6		
8	26	Data 7		
9	27	Data 8		

Table 2–1 Parallel Interface Lines (cont'd)

SIGNAL PIN	RETURN PIN	SIGNAL	DIRECTION	DESCRIPTION
10	28	Acknowledge ($\overline{\text{ACKNLG}}$)	From printer	This signal goes low when ● the signal has been changed from deselect to select. ● the printer is ready to receive data. ● initialization (INLZ) is complete. ● an alarm or error occurs.
11	29	Busy	From printer	This signal goes high when ● $\overline{\text{Input}}$ $\overline{\text{Prime}}$ is received. ● an alarm or error occurs. ● $\overline{\text{Data}}$ $\overline{\text{Strobe}}$ is received (ready to receive data after processing received data). ● the 256-character buffer becomes full after the PAUSE/CONTINUE switch is pressed. The Busy state continues when the printer is out of paper, in the Pause state, or jammed. However, when paper jams, a single character can be received. The signal goes low after INLZ is completed.

Table 2–1 Parallel Interface Lines (cont'd)

SIGNAL PIN	RETURN PIN	SIGNAL	DIRECTION	DESCRIPTION
12	30	Paper Empty (PE)	From printer	This status line goes high when the printer is out of paper.
13	–	Select	From printer	This line goes high when ● the PAUSE/CONTINUE switch is pressed in the Pause state. ● INLZ is completed. The signal goes low when ● the 256–character buffer is full after the PAUSE/CONTINUE switch is pressed (Select=1). ● the Busy signal is high due to a paper jam or paper empty (PE) condition. ● an alarm occurs. ● the printer test is being run.
14	–	$\overline{\text{Auto Feed}}$ $\overline{\text{XT}}$	To printer	When this line is low, the printer performs an automatic line feed with a CR code. This signal must continue during the time when the Strobe signal goes low and the $\overline{\text{ACKNLG}}$ signal is sent.

Table 2-1 Parallel Interface Lines (cont'd)

SIGNAL PIN	RETURN PIN	SIGNAL	DIRECTION	DESCRIPTION
15	–	–	–	Not used.
16	–	SG	–	Signal ground
17	–	FG	–	Frame ground
18	–	+5 V	–	Not used.
19, 20 21, 22 23, 24 25, 26 27, 28 29, 30	–	Gnd	–	Ground. Pins 19–27 are ground for data 1–8, pin 28 is ground for $\overline{\text{ACKNLG}}$, pin 29 is ground for Busy, and pin 30 is ground for PE.
31	–	$\overline{\text{Input Prime}}$	To printer	When this signal goes low after INLZ is completed. When this signal is received during the Pause state, it is latched and executed in the Continue state. All data remaining in the page buffer is printed. When the data is not sufficient to fill one page, the remainder of the page will be blank. The start and execution of initialization has no effect on the Select signal status. The RAM-loaded table is not affected by these processes. It is cleared when an alarm is issued.

Table 2–1 Parallel Interface Lines (cont'd)

SIGNAL PIN	RETURN PIN	SIGNAL	DIRECTION	DESCRIPTION
32	–	$\overline{\text{Fault}}$	From printer	This line goes low when • the PAUSE/CONTINUE switch is pressed (Select=0 and SW1–7 is on). • paper empty or paper jam is detected. • an alarm or error occurs.
33	–	SG	–	Signal ground
34	–	–	–	Not used.
35	–	+5 V	–	Not used.
36	–	$\overline{\text{SLCT IN}}$	To printer	When this signal is high, DC3 is valid. When this signal is low, input data, including DC1, is valid. This signal will be low until an $\overline{\text{ACKNLG}}$ is sent after $\overline{\text{Strobe}}$.

TIMING

The timing relationships of the interface signals are shown in Figures 2–3 through 2–12.

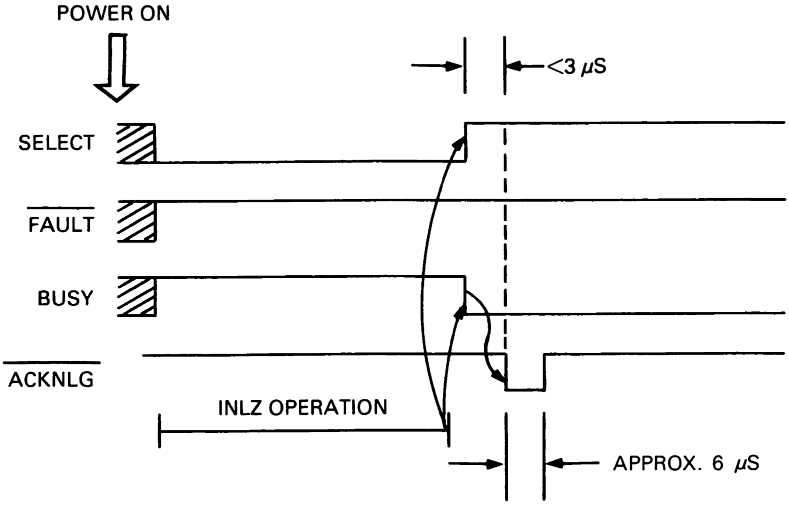


Figure 2–3 Timing at Power-On

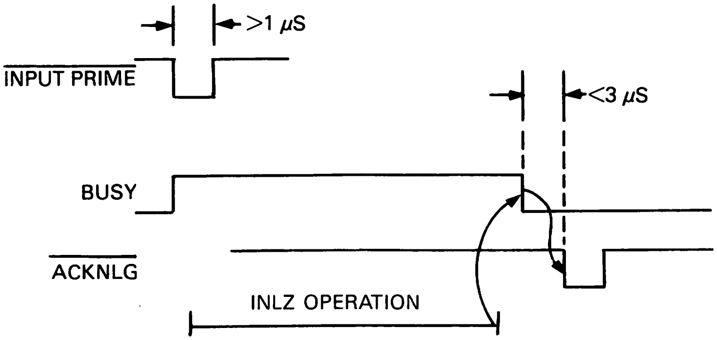


Figure 2–4 Input Prime

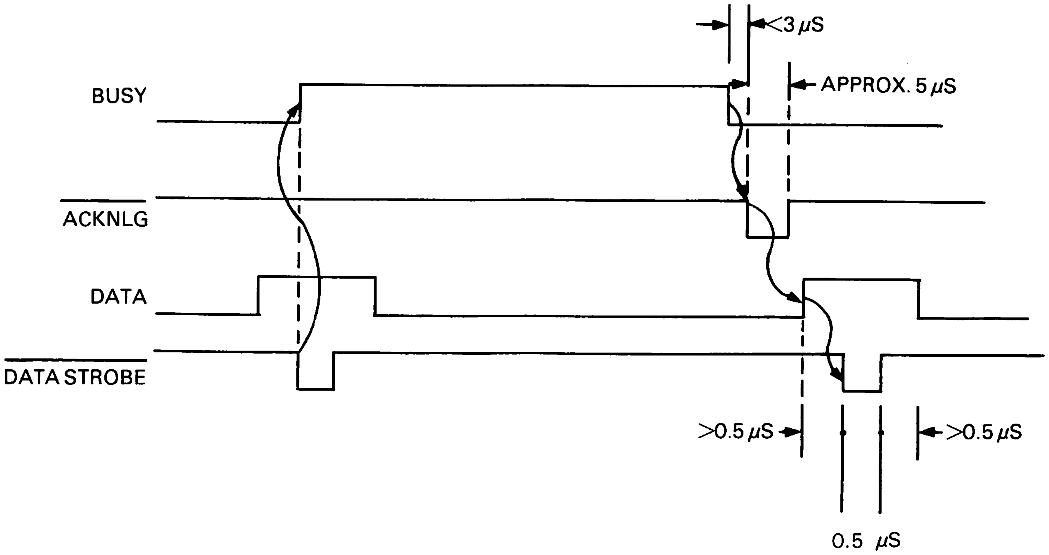


Figure 2–5 $\overline{\textbf{Data Strobe}}$

Figure 2–6 shows error or alarm timing. An error is caused by any of the following:

- paper empty
- incorrect paper size
- interface
- sensor
- toner empty
- paper jam
- cover open
- PC cartridge needs replacing.

An alarm is caused by any of the following:

- overheating
- overrun
- CPU B
- LED head
- CPU A
- CPU C.

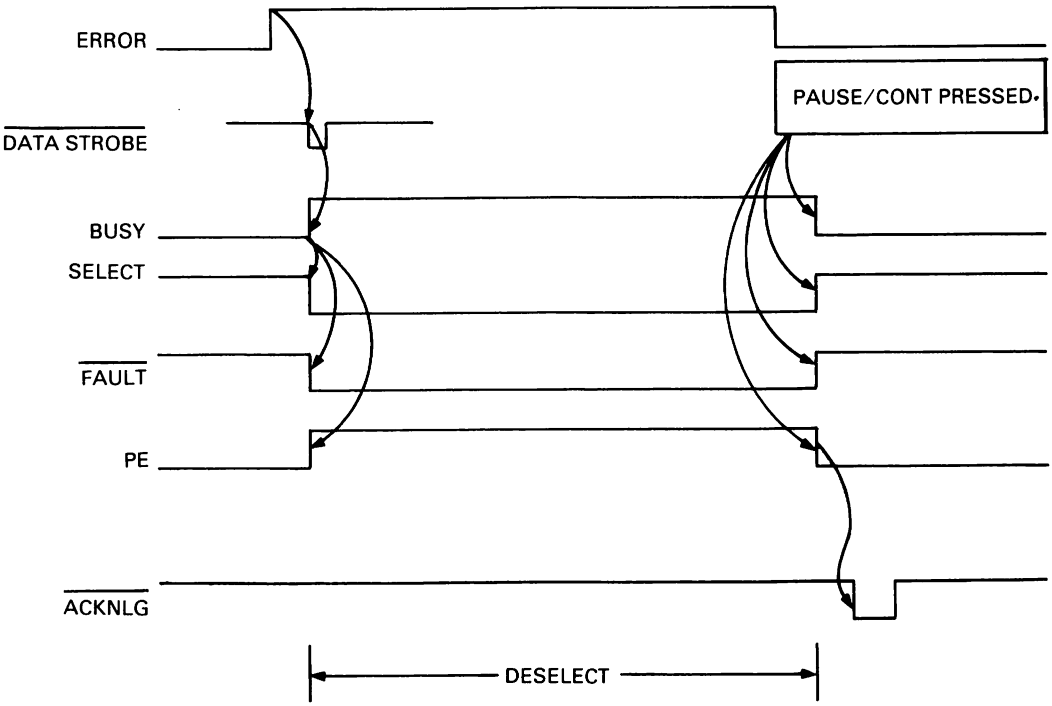


Figure 2–6 Error or Alarm

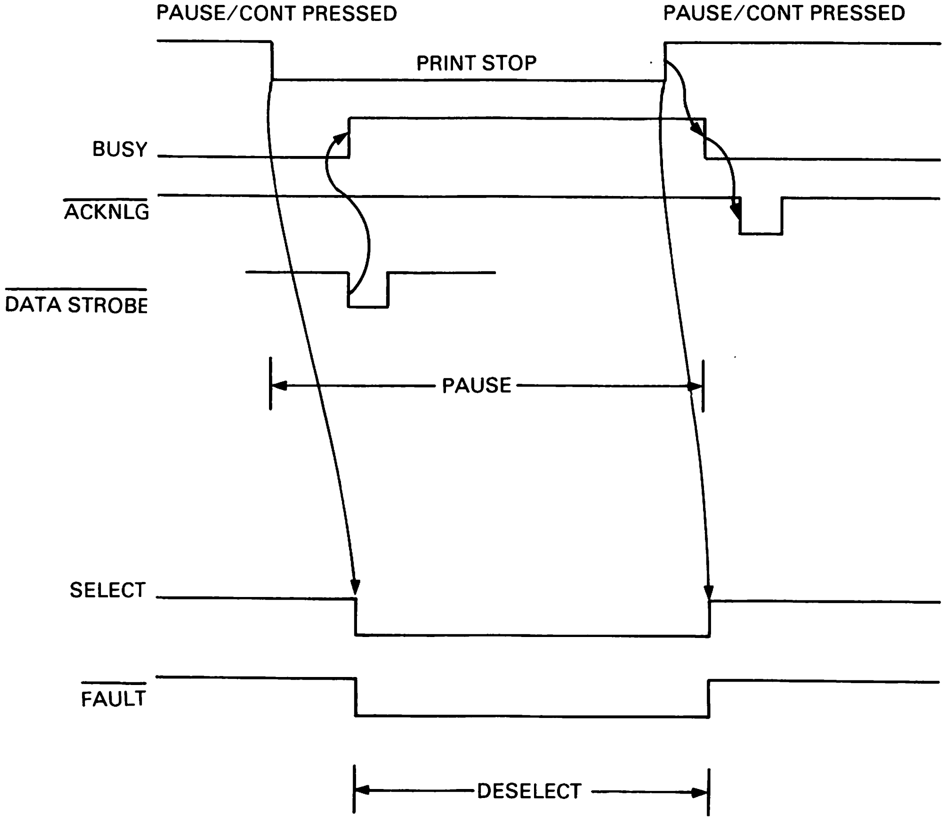


Figure 2–7 Pause/Continue

When SLCT IN is high, DC1/DC3 turns the select signal on or off. Regardless of whether SLCT IN is high or low, ACKNLG and busy are sent when data, including DC1 or DC3, is received. After DC1 is received, Data C is invalid and Data D is valid.

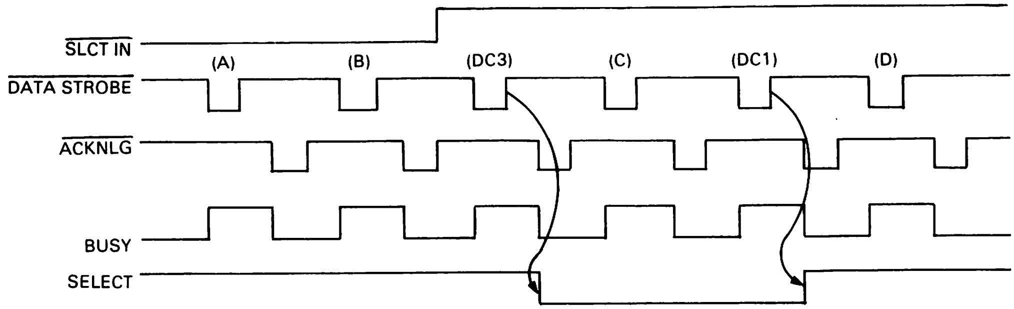

$\overline{\text{SLCT IN}}$
$\overline{\text{DATA STROBE}}$
$\overline{\text{ACKNLG}}$
BUSY
SELECT
(A)
(B)
(DC3)
(C)
(DC1)
(D)

Figure 2-8 Receiving DC1/DC3 ($\overline{\text{SLCT IN}}$ = High)

When $\overline{\text{SLCT IN}}$ is low, DC1/DC3 is not affected when the select signal goes on or off. When DC1 is in the data stream, previous data is ignored. When $\overline{\text{SLCT IN}}$ is high, DC1 ignores the previous data.

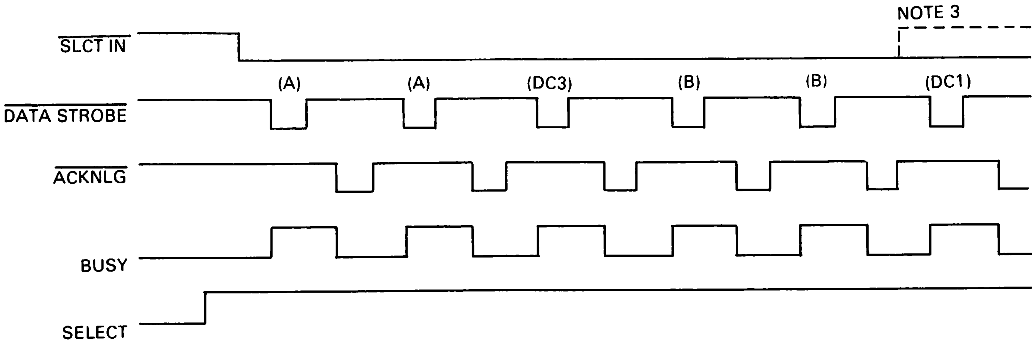

NOTE 3
$\overline{\text{SLCT IN}}$
$\overline{\text{DATA STROBE}}$
$\overline{\text{ACKNLG}}$
BUSY
SELECT
(A)
(A)
(DC3)
(B)
(B)
(DC1)

Figure 2-9 Receiving DC1/DC3 ($\overline{\text{SLCT IN}}$ = Low)

If data (including DC1/DC3) is received when the select signal is low, the $\overline{\text{ACKNLG}}$ and busy signals are sent regardless of $\overline{\text{SLCT IN}}$. Received data, excluding DC1, becomes invalid. Received data makes the function valid when SELECT = 1 and $\overline{\text{SLCT IN}}$ = 0.

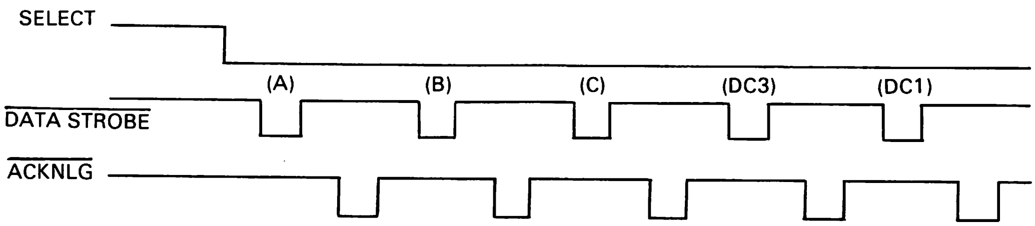


Figure 2–10 Receiving Data When SLCT = Low (Including DC1/DC3)

Paper Empty goes high when or after a paper–out condition is detected.

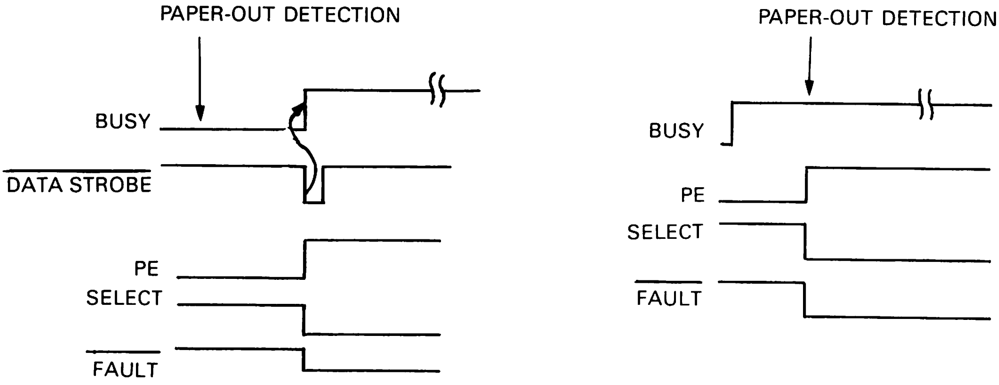


Figure 2–11 Paper Empty

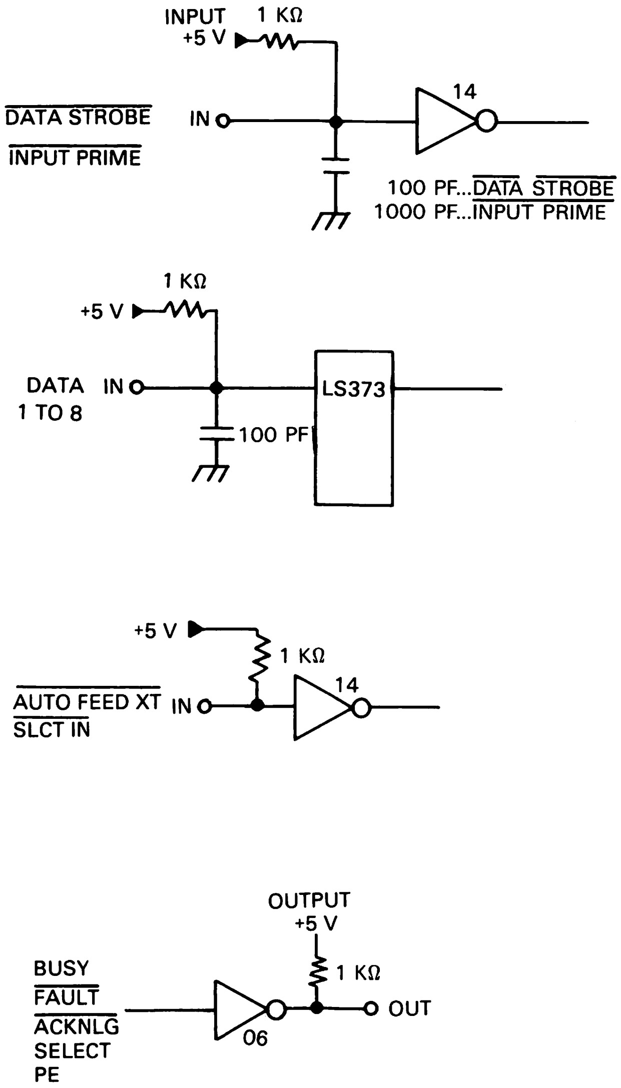
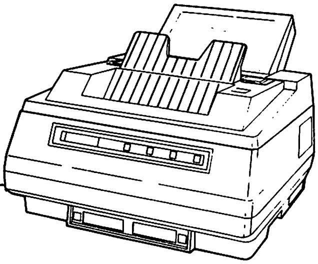


Figure 2–12 Interface Logic



Section 3

Serial Interface

This section describes the signal and data lines, timing, and data format for the serial interface, and lists the interface connector pin assignments. The section also describes serial interface switch settings and their functions.

LINES

Figure 3–1 shows the arrangement of the interface connector pins.

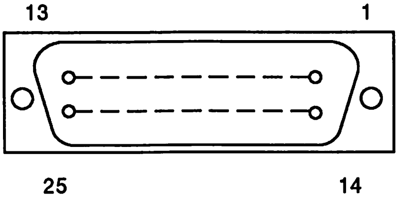


Figure 3–1 Arrangement of Connector Pins

Figure 3–2 shows signal and control lines across the printer's serial interface. Table 3–1 describes these lines.

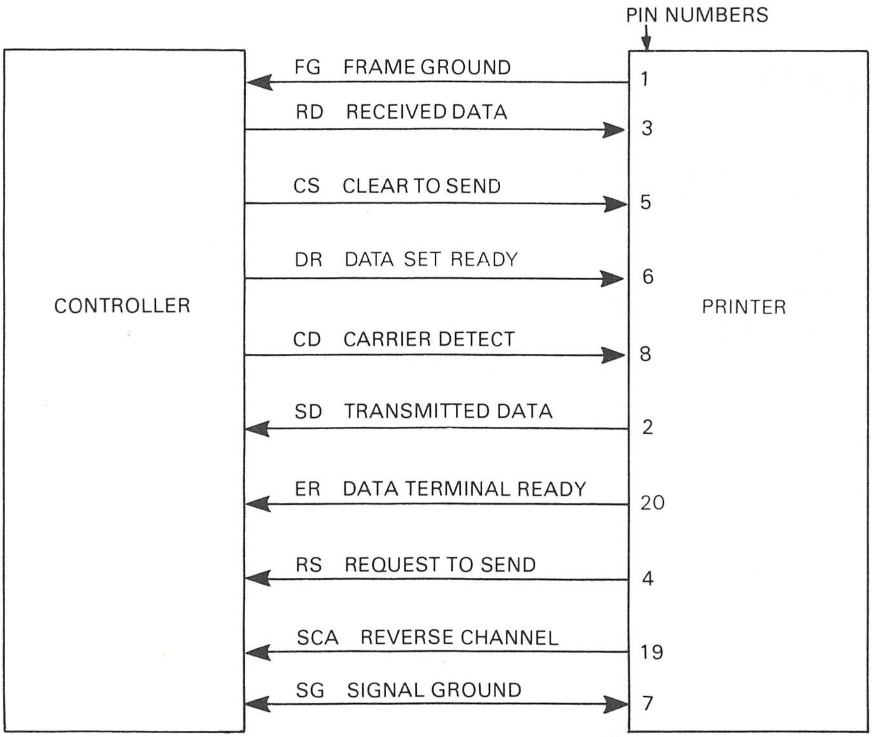


Figure 3–2 Serial Interface Lines Diagram

Table 3–1 Serial Interface Lines

PIN NUMBER	SIGNAL/CONTROL LINE	DIRECTION OF SIGNAL	DESCRIPTION
1	Frame Ground (FG)	From printer	Grounding for protection.
2	Send Data (SD)	From printer	SD goes on and allows data to be sent when RS and CS are on.
3	Received Data (RD)	To printer	When this signal, RS, and CD are on, data is being received. This signal is received 10 ms after DR goes on.

Table 3–1 Serial Interface Lines (cont'd)

PIN NUMBER	SIGNAL/CONTROL LINE	DIRECTION OF SIGNAL	DESCRIPTION
4	Request to Send (RS)	To printer	This signal goes on when both ER and DR are on. The signal goes off when either ER or DR is off.
5	Clear to Send (CS)	To printer	This line must be on to allow data to be sent.
6	Data Set Ready (DR)	To printer	This signal indicates that the remote controller is ready to operate. Sending and receiving data is prohibited when this signal is off. When DR goes on, RS goes on.
7	Signal Ground (SG)	To/from printer	Grounding for signal.
8	Carrier Detect (CD)	To printer	Sending and receiving data is prohibited when this signal is off. When the CD signal is not required on the interface signal line, SW3–1 should be on.
19	Reverse Channel (SCA)	From printer	This signal sends a request for data. By setting SW3–2, it is possible to change polarity. This line goes off when the amount of data in the receiving buffer is over 224 bytes.

Table 3-1 Serial Interface Lines (cont'd)

PIN NUMBER	SIGNAL/CONTROL LINE	DIRECTION OF SIGNAL	DESCRIPTION
20	Data Terminal Ready (ER)	From printer	This signal, normally kept on, indicates that the printer is ready to operate. This signal goes off when an alarm occurs. The signal goes off for 500 ms when: ● the CD signal stays off for over 30 seconds and ● the DR signal is on. This signal goes off for 500 ms when the CD signal goes off for more than 10 seconds.

TIMING

The timing relationships of the interface signals are shown in Figures 3–3 and 3–4. CS stays on when SW3–1 is on. If CD does not go on within 30 ms after DR goes on, ER and RS go off. ER and RS go off when CD stays off for more than 500 ms. ER and RS go off when a printer error occurs. Sending and receiving data is prohibited.

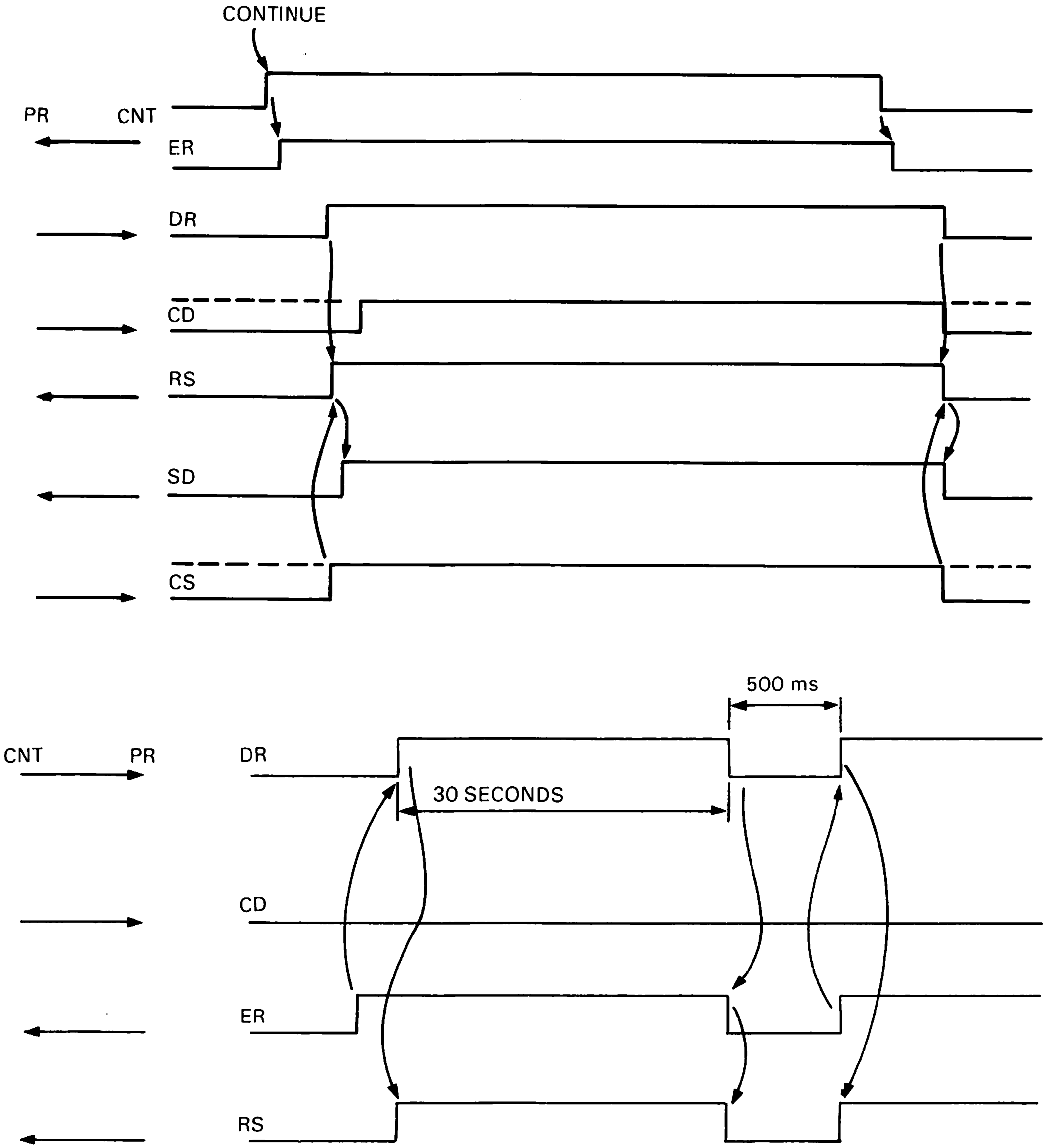


Figure 3–3 Timing Diagram 1

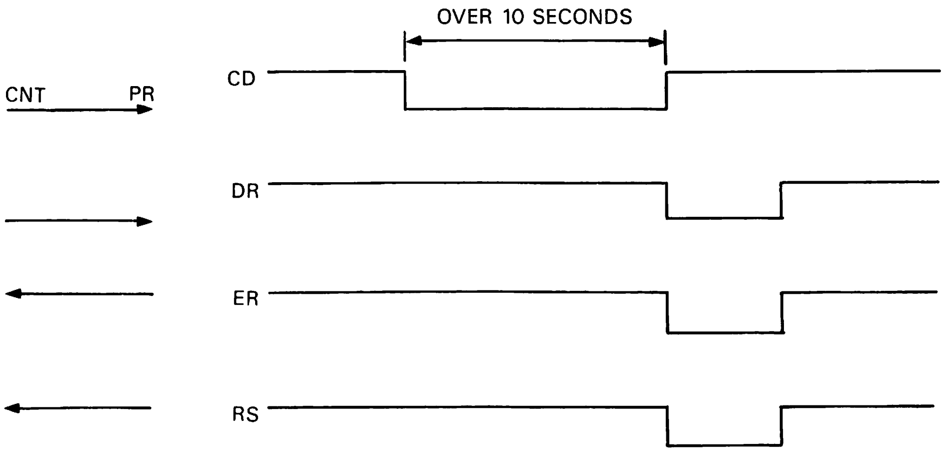


Figure 3–4 Timing Diagram 2

SIGNAL LEVELS

Data signals are –12 V for logic "1" (designated as Mark), and +12 V for logic "0" (designated as Space). All other signals are +12 V on, or high, and –12 V off, or low.

Figure 3–5 shows the signal levels for the serial interface.

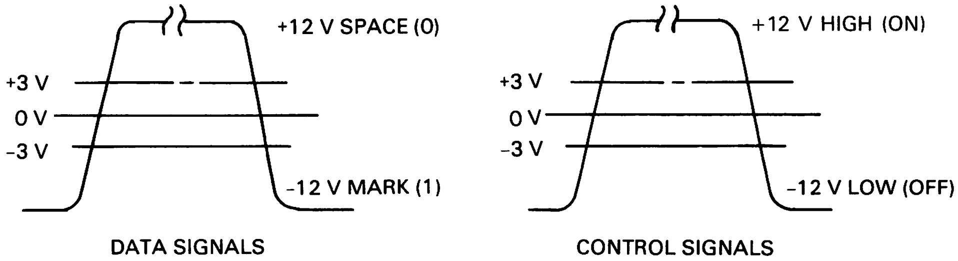


Figure 3–5 Serial Interface Signal Levels

DATA FORMAT

The serial, asynchronous ASCII data from the transmit or receive data circuit is shown in Figure 3-6. If the circuit does not contain data, it should be held in the Mark state.

A character begins when the Mark signal changes to the Space signal (start bit).

The data transfer rate ranges from 150 to 19,200 baud.

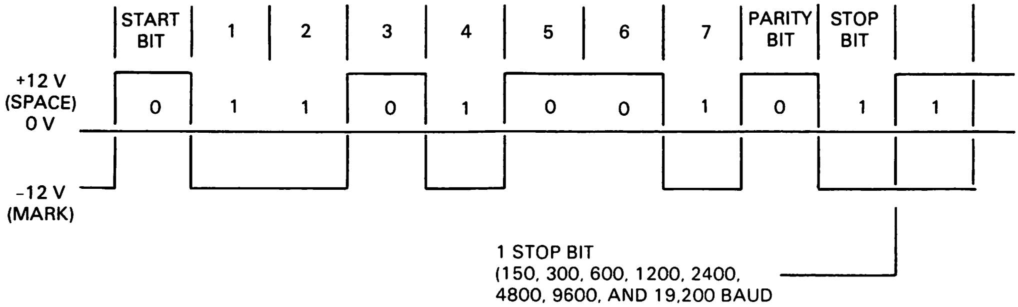
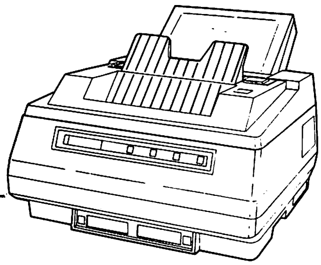


Figure 3-6 ASCII Data Format



Section 4

Print Styles

The LC 850 produces many different print styles, giving you a wide selection of character width, spacing, and weight. This section explains how to select the print style that is suitable to your needs.

FONT SELECTION

Four resident fonts are supplied with the printer: Courier 10 Pitch Portrait, Courier 12 Pitch Landscape, Courier Italic 10 Pitch Portrait, and Courier Symbol 10 Pitch.

To select a font, press **PAUSE CONTINUE** on the control panel. Then press **FONT SET** until the name of the desired font appears on the display. Press **PAUSE CONTINUE** again.

You can also use the following software command (refer to Section 7).

```
FS ) <m11 m12> <n11 n12>
```

CHARACTER WIDTH AND SPACING

Software commands enable you to specify the spacing between characters and the width of the characters themselves.

The most commonly used pitches are 10 characters per inch (cpi) and 12 cpi. The printer also offers a proportional spacing (PS) feature which allots space to a character depending upon the width of that character.

The printer also produces magnified (elongated) and condensed printing. Magnified characters are double the current character width. Condensed printing produces 17 characters per inch.

NOTE

Switch 1–4 must be off to enable pitch selection.

Table 4–1 provides the print style commands for both the NEC XX50 codes and the IBM Proprinter™ emulation. See the appropriate programming section for a further explanation of each code.

Table 4–1 Character Width and Spacing Commands

PRINT MODE	NEC XX50 CODE	IBM PROPRINTER CODE
10 cpi	ESC S	DC2
12 cpi	ESC I	ESC :
Magnified (Elongated)	FS +(α)	FS +(α), SO, ESC W(n)
Condensed	ESC SI	SI

CHARACTER WEIGHTS

The LC 850 produces bold, shadow, screen (dot mesh), and white-on-black (reverse) printing. Table 4–2 provides the software codes for selecting these types of printing. See the appropriate programming section for an explanation of each code.

Table 4–2 Character Weight Commands

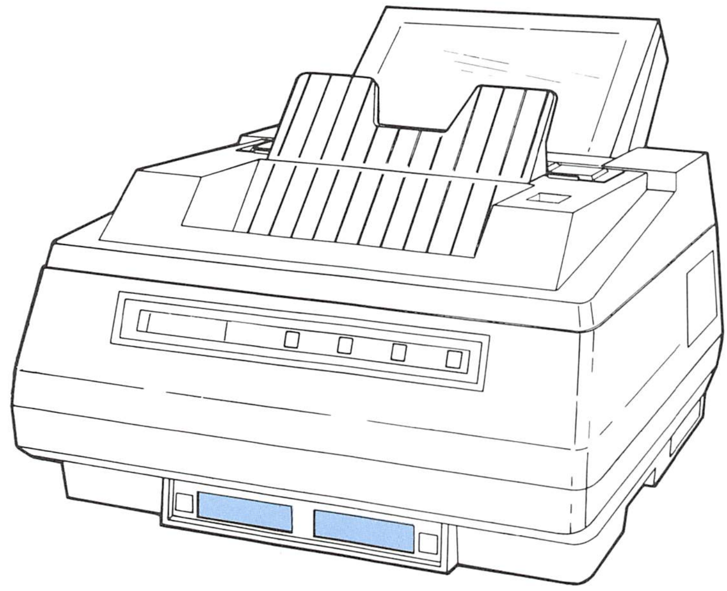
PRINT MODE	NEC XX50 CODE	IBM PROPRINTER CODE
Bold	ESC E	ESC G
Shadow	ESC G	ESC E
Screen	FS ,(α)	FS ,(α)
White–on–black	FS –(α)	FS –(α)

FONT CARTRIDGES

In addition to the printer's four resident fonts, optional font cartridges can be purchased to further extend the number of print styles. These cartridges can be inserted, one or two at a time, into the designated slots on the front of the printer.

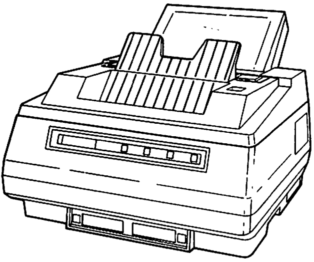
NOTE

Font cartridges must not be installed while printing is in progress.



Section 5

NEC XX50 Command Set



This section supplies you with programming explanations and code descriptions for the XX50 commands. These commands can be selected either by setting SW1-2, located at the rear of the printer, to the off position, or by the form separator sequence FS C(z). The XX50 commands include all FS sequences, which are explained in Section 7.

This section is intended for users who write their own programs, and assumes some knowledge of BASIC programming. Users who do not write programs but depend on preprogrammed applications packages can skip this section completely, or read it for insight into how the printer works.

ASCII CODING

Tables 5-1 and 5-2 list the ASCII codes that can be used to control the printer. ESC }a selects Character Set 1, and ESC }b selects Character Set 2. The bold 0 to F numbers on the top and left side are the hexadecimal (hex) numbers for the alphanumeric, special, and graphics characters inside the boxes. The numbers inside the boxes, underneath the characters, are decimal equivalents of the hex numbers for these characters.

Programming ASCII Characters

To print ASCII character "A" from the table, use the ASCII A, its decimal equivalent, 65, or its hex equivalent, 41 (column 4, row 1). In BASIC you could use any of the following.

- LPRINT "A"
- LPRINT CHR$(65)
- LPRINT CHR$(&H41)

The preceding examples were for an uppercase “A”. For a lowercase “a,” the decimal equivalent is 97, not 65. The hex equivalent is 61, not 41. The following examples print a lowercase “a”.

- LPRINT “a”
- LPRINT CHR$(97)
- LPRINT CHR$(&H61)

Table 5–1 ASCII Table for Character Set 1 (Standard)

SECOND HEX DIGIT	FIRST HEX DIGIT															
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**
0	NUL 00	16	SP 32	0 48	@ 64	P 80	\ 96	p 112	NUL 128	144	á 160	░ 176	└ 192	┴ 208	α 224	≡ 240
1	01	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	129	DC1 145	í 161	▒ 177	┴ 193	┬ 209	β 225	± 241
2	STX 02	DC2 18	" 34	2 50	B 66	R 82	b 98	r 114	STX 130	DC2 146	ó 162	▓ 178	┬ 194	┬ 210	T 226	≥ 242
3	ETX 03	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115	ETX 131	DC3 147	ú 163	│ 179	├ 195	└ 211	π 227	≤ 243
4	04	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	132	DC4 148	ñ 164	┤ 180	─ 196	└ 212	Σ 228	⌠ 244
5	05	§ 21	% 37	5 53	E 69	U 85	e 101	u 117	133	§ 149	Ñ 165	┤ 181	┼ 197	┌ 213	σ 229	⌡ 245
6	06	22	& 38	6 54	F 70	V 86	f 102	v 118	134	150	ª 166	┤ 182	├ 198	┌ 214	μ 230	÷ 246
7	BEL 07	23	' 39	7 55	G 71	W 87	g 103	w 119	BEL 135	151	º 167	┐ 183	├ 199	┼ 215	τ 231	≈ 247
8	08	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	136	CAN 152	¿ 168	┐ 184	└ 200	┼ 216	Φ 232	° 248
9	HT 09	25	) 41	9 57	I 73	Y 89	i 105	y 121	HT 137	153	⌐ 169	┤ 185	┌ 201	┘ 217	Θ 233	■ 249
A	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	LF 138	154	¬ 170	│ 186	┴ 202	┌ 218	Ω 234	— 250
B	11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	139	ESC 155	½ 171	┐ 187	┬ 203	█ 219	δ 235	√ 251
C	FF 12	FS 28	, 44	< 60	L 76	\ 92	l 108	¦ 124	FF 140	FS 156	¼ 172	┘ 188	├ 204	■ 220	∞ 236	η 252
D	CR 13	29	— 45	= 61	M 77	] 93	m 109	} 125	CR 141	157	¡ 173	┘ 189	─ 205	▌ 221	φ 237	² 253
E	SO 14	30	. 46	> 62	N 78	≙ 94	n 110	~ 126	SO 142	158	« 174	┘ 190	┼ 206	▐ 222	ε 238	■ 254
F	SI 15	US 31	/ 47	? 63	O 79	_ 95	o 111	127	SI 143	US 159	» 175	┐ 191	┴ 207	■ 223	∩ 239	255

Table 5-2 ASCII Table for Character Set 2 (IBM)

SECOND HEX DIGIT	FIRST HEX DIGIT															
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**
0	NUL 00	16	SP 32	0 48	@ 64	P 80	\ 96	p 112	Ç 128	É 144	á 160	░ 176	└ 192	╨ 208	α 224	≡ 240
1	01	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	ü 129	æ 145	í 161	▒ 177	┴ 193	╤ 209	β 225	± 241
2	02	DC2 18	″ 34	2 50	B 66	R 82	b 98	r 114	é 130	Æ 146	ó 162	▓ 178	┬ 194	╥ 210	Γ 226	≥ 242
3	♥ 03	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243
4	♦ 04	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	ä 132	ö 148	ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244
5	♣ 05	§ 21	% 37	5 53	E 69	U 85	e 101	u 117	à 133	ò 149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
6	♠ 06	22	& 38	6 54	F 70	V 86	f 102	v 118	å 134	û 150	ª 166	╢ 182	╞ 198	╓ 214	μ 230	÷ 246
7	BEL 07	23	′ 39	7 55	G 71	W 87	g 103	w 119	ç 135	ù 151	º 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247
8	08	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	ê 136	ÿ 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248
9	HT 09	25	) 41	9 57	I 73	Y 89	i 105	y 121	ë 137	Ö 153	⌐ 169	╣ 185	╔ 201	┘ 217	Θ 233	■ 249
A	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	— 250
B	11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	ï 139	¢ 155	½ 171	╗ 187	╦ 203	█ 219	δ 235	√ 251
C	FF 12	28	, 44	< 60	L 76	\ 92	l 108	¦ 124	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	η 252
D	CR 13	29	— 45	= 61	M 77	] 93	m 109	} 125	ì 141	¥ 157	¡ 173	╜ 189	═ 205	▌ 221	φ 237	² 253
E	SO 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	Ä 142	₧ 158	« 174	╛ 190	╬ 206	▐ 222	ε 238	■ 254
F	SI 15	US 31	/ 47	? 63	O 79	_ 95	o 111	127	Å 143	ƒ 159	» 175	┐ 191	╧ 207	▀ 223	∩ 239	255

Programming Control Codes

Control codes are nonprintable ASCII codes that control various printer functions. Examples of this type of function are condensed and elongated printing. To send any control code to the printer, using BASIC programming, use the hexadecimal or decimal value of the code you want. For example, LPRINT CHR$(x), where x is the decimal or hex equivalent of the control code you want, sends the code to the printer. Thus,

```
LPRINT CHR$(13)
```

sends a carriage return code to the printer. CHR$(13) is the decimal of the carriage return control code.

Control codes are always sent using their decimal or hexadecimal equivalents. For example, here are correct and incorrect ways to send a form feed control code.

• Incorrect:	LPRINT "FF"
• Correct (decimal form):	LPRINT CHR$(12)
• Correct (hex form):	LPRINT CHR$(&HOC)

Programming Escape (ESC) Sequences

Escape sequences are combinations of the ESC control code and control characters. They are used to program various functions such as tabs, forms length, or margins. An escape sequence always consists of the ESC control code followed by one or more characters.

For example, to program ESC A, you have three choices.

ASCII character form:	LPRINT CHR$(27);"A"
Decimal form:	LPRINT CHR$(27);CHR$(65)
Hex form:	LPRINT CHR$(H1B);CHR$(&H41)

In this guide, ESC A(n) indicates that (n) is a numeric (decimal or hex) value.

CONTROL CODES

The following is an explanation of each XX50 control code. A sample BASIC programming line or program is included for each code.

See Appendix A for a quick reference to these control codes.

NUL

Null

NUL control code terminates the escape sequences that set horizontal and vertical tabs (see ESC B (n1)(n2)(n...) NUL and ESC D (n1)(n2)(n...) NUL).

```
LPRINT CHR$(&H00)
```

STX

Shift Out

STX cancels the ETX code and resumes printing of the standard 96 ASCII characters.

```
LPRINT CHR$(&H02)
```

ETX

Shift In

ETX accesses the extended character set (beyond the standard 96 ASCII characters) until an STX code is received. The 128–character print wheel must be installed. When SW3–3 is off, this function is cancelled.

```
LPRINT CHR$(&H03)
```

BEL

Bell

BEL sounds the printer buzzer for approximately 500 ms.

```
LPRINT CHR$(&H07)
```

BS

Back Space

BS moves the print position one space to the left. The space is the current setting of the horizontal motion index (HMI), or 1/60 in. in graphics mode. If the printer is in right–to–left print mode, this code moves the print position one space to the right.

If the print position is already at the farthest left or right position of the paper when the BS code is received, the code is ignored. This code allows the print position to move beyond the right and left margins.

```
10 'BACK SPACE
20 '
30 LPRINT "Can you use Back Space function ?"
40 '
50 LPRINT "Yes.I'm using Back Space Function now!";
60 '
70 FOR I = 1 TO 24
80    LPRINT CHR$(&H8);'Back Space
90 NEXT
100 '
110 LPRINT "________________________        "
120 END
```

```
Can you use Back Space function ?
Yes.I'm using Back Space Function now!
```

HT

Horizontal Tab

HT advances the print position to the next preset horizontal tab (see ESC D (n1)(n2)(n...) NUL). If no horizontal tab is set, HT is ignored. If a tab is set past the edge of the paper, the carriage moves to the left–most column of the paper.

When the current print position is at a preset tab position, the HT command moves the print position to the next preset tab position.

```
LPRINT CHR$(&H09)
```

LF

Line Feed

LF advances the paper one line when SW2–6 is on. Line spacing is set by the vertical motion index (VMI). In the graphics mode, LF advances the paper 1/48 in.

When a carriage return is performed with SW2–1 on, the following modes are cancelled:

- bold printing (ESC E)
- shadow printing (ESC G
- right–to–left printing (ESC Z)
- offset selection (ESC %)

When an LF code is received in the graphics mode, the setting of SW2–1 is ignored and a carriage return is not performed.

If the line feed pitch is less than the height of the tallest character in the top line of the paper, the print reference line is automatically lowered.

```
10 'Line Feed
20 '
30 LPRINT "FIRST LINE"; CHR$(10); "SECOND LINE"
40 END
```

```
FIRST LINE
          SECOND LINE
```

VT

Vertical Tab

VT advances the print position to the next preset vertical tab (see ESC B (n1)(n2)(n...) NUL). If no vertical tab is set between the current position and the next top-of-form (TOF), the paper advances one line. If the next vertical tab is set beyond the bottom edge of the paper, the paper is ejected and the VT position moves to the next top-of-form.

When a carriage return is performed with SW2-1 on, the following modes are cancelled:

- bold printing (ESC E)
- shadow printing (ESG G)
- right-to-left printing (ESC Z)
- offset selection (ESC %)

```
LPRINT CHR$(&H0B)
```

FF

Form Feed

FF advances the paper to the next TOF position. A carriage return is performed when SW2–1 is on, except when the graphics mode is in effect. A carriage return cancels the following modes:

- bold printing (ESC E)
- shadow printing (ESC G)
- right-to-left printing (ESC Z)
- offset selection (ESC %)

```
10 'Form Feed
20 '
30 FOR I = 1 TO 3
40    LPRINT "Printing 3 lines on page !"
50 NEXT I
60 '
70 LPRINT CHR$(&HC);
80 LPRINT "Printing 1st line of next page ..."
90 '
100 FOR J = 1 TO 5
110    LPRINT "and keep on printing."
120 NEXT J
130 '
140 END
```

```
Printing 3 lines on page !
Printing 3 lines on page !
Printing 3 lines on page !

Printing 1st line of next page ...
and keep on printing.
and keep on printing.
and keep on printing.
and keep on printing.
and keep on printing.
```

CR

Carriage Return

CR returns the print position to the left margin. If SW2-6 is on or the Auto Feed XT signal is off, the printer performs one line feed.

CR cancels the following modes:

- bold printing (ESC E)
- shadow printing (ESC G)
- right-to-left printing (ESC Z)
- graphics mode (ESC .)

```
10 'Carriage Return
20 '
30 LPRINT "Underscore";
40 LPRINT CHR$(&HD);
50 LPRINT "__________"
60 LPRINT
70 LPRINT "Strike Out";
80 LPRINT CHR$(&HD);
90 LPRINT "////// ///"
100 '
110 END
```

Underscore

~~Strike Out~~

SO

Double Space

SO doubles the HMI. In the automatic PS mode, this code doubles the bearing value. In the program mode, SO doubles the spacing pitch.

LPRINT CHR$(&H0E)

SI

HMI 17 cpi

Sets the HMI to 17 cpi.

The following codes cancel SI.

DC2 ESC 5 ESC + ESC I
ESC S ESC = ESC] - 0

This code is ignored when SW1–5 is on.

```
LPRINT CHR$(&H0F)
```

NOTE: Do not use this command with 10 cpi fonts as crowding may occur.

DC1

Sets Continue State

DC1 cancels the Pause state and puts the printer in the Continue state. When a DC1 code is received in the Continue state, one line of previously received data is ignored.

```
LPRINT CHR$(&H11)
```

DC2

Cancels SI

DC2 cancels SI (17 cpi) and returns the printer to the previously set print mode.

```
LPRINT CHR$(&H12)
```

DC3

Sets Pause State

DC3 puts the printer in the Pause state, placing it offline and preventing it from receiving or transmitting data. The printer ejects the paper, and the Pause light on the operator control panel goes on.

```
LPRINT CHR$(&H13)
```

DC4

Cancels SO

DC4 cancels the double–space mode previously set by the SO code.

```
LPRINT CHR$(&H14)
```

CAN

Cancel

CAN cancels the printing of all data back to the last return (maximum of one line, 256 characters).

The CAN mode is set when SW1–8 is on. When SW1–8 is off, the CAN code is ignored.

```
LPRINT CHR$(&H18)
```

SP

Space

SP moves the print position one space to the right. The width of the space corresponds to the specified HMI.

When pitch select mode is selected (SW1–4 is off), the pitch of the space is equal to the HMI.

When pitch select mode is not selected (SW1–4 is on), the space is equal to the width of the previous printed character.

When auto return is on, an automatic return is performed.

In right–to–left print mode, a backspace occurs.

When this code appears in the right or left margin column, no space is inserted.

```
LPRINT CHR$(&H20)
```

DEL

Delete

DEL cancels the printing of all data back to the last carriage return (maximum of one line, 256 characters). The delete mode is set when SW1–9 is on. When SW1–9 is off, the DEL code is ignored.

```
LPRINT CHR$(&H7F)
```

ESCAPE SEQUENCES

The following is an explanation of each XX50 escape sequence. A sample BASIC programming example is included with most sequences. See Appendix A for a quick reference to these escape sequences.

ESC 0 **8 lpi**

ESC 0 sets the line spacing at 8 lpi.

```
10 'Set Line Feed Pitch 8 LPI
20 '
30 FOR I = 1 TO 3
40 LPRINT "Normal line spacing pitch"
50 NEXT I
60 LPRINT
70 '
80 FOR J = 1 TO 3
90 LPRINT CHR$(&H1B);CHR$(&H30);
100 LPRINT "Set Line Feed Pitch 8 LPI !"
110 NEXT J
120 '
130 END
```

```
Normal line spacing pitch
Normal line spacing pitch
Normal line spacing pitch

Set Line Feed Pitch 8 LPI !
Set Line Feed Pitch 8 LPI !
Set Line Feed Pitch 8 LPI !
```

ESC 1

10 lpi

ESC 1 sets the line spacing at 10 lpi.

```
10 'Set Line Feed Pitch 10 LPI
20 '
30 FOR I = 1 TO 3
40 LPRINT "Normal line spacing pitch"
50 NEXT I
60 LPRINT
70 '
80 FOR J = 1 TO 3
90 LPRINT CHR$(&H1B);CHR$(&H31);
100 LPRINT "Set Line Feed Pitch 10 LPI !"
110 NEXT J
120 '
130 END
```

```
Normal line spacing pitch
Normal line spacing pitch
Normal line spacing pitch

Set Line Feed Pitch 10 LPI !
Set Line Feed Pitch 10 LPI !
Set Line Feed Pitch 10 LPI !
```

ESC 2

6 lpi

The first time ESC 2 is received, the line spacing is set at the current VMI value (set by ESC A(n)). Subsequent reception of this ESC sequence sets line spacing at 6 lpi.

```
10 'Set Line Feed Pitch 6 LPI
20 '
30 FOR I = 1 TO 3
40 LPRINT "Normal line spacing pitch"
50 NEXT I
60 LPRINT
70 '
80 FOR J = 1 TO 3
90 LPRINT CHR$(&H1B);CHR$(&H32);
100 LPRINT "Set Line Feed Pitch 6 LPI !"
110 NEXT J
120 '
130 END
```

```
Normal line spacing pitch
Normal line spacing pitch
Normal line spacing pitch

Set Line Feed Pitch 6 LPI !
Set Line Feed Pitch 6 LPI !
Set Line Feed Pitch 6 LPI !
```

ESC 5

RAM Table Select

ESC 5 selects the RAM table and prints the succeeding data. The automatic proportional spacing mode is set. Unless otherwise specified, the spacing pitch is 12 cpi and the line feed pitch is 6 lpi. This code cancels the double-space mode (ESC SO), graphics mode (ESC .), and program mode (ESC P).

LPRINT CHR$(&H1B);CHR$(&H35)

ESC 7

Reverse Line Feed

ESC 7 causes the printer to perform a reverse line feed according to the current VMI value. No carriage return is performed regardless of the setting of SW2-1.

If the current print position is at the top margin, this command is ignored.

```
10 'Line Feed/Negative Line Feed
20 '
30 LPRINT "First Line";
40 '
50 LPRINT CHR$(&HA);
60 LPRINT "Second Line";
70 '
80 LPRINT CHR$(&H1B);CHR$(&H37);
90 LPRINT "First Line Again !"
100 '
110 END
```

```
First Line          First Line Again !
          Second Line
```

ESC A(n)

VMI Line Feed

ESC A(n) specifies the amount of line feeding according to the Vertical Motion Index (VMI). The VMI range is 0/48 in. to 57/48 in.

This code stores the VMI in memory. Reception of the ESC 2 code enables VMI. Repeated ESC 2 codes cause the VMI to be 6 lpi.

The VMI is cleared by ESC =, ESC 0 (8 lpi), ESC 1 (10 lpi), and ESC 2 (6 lpi).

The maximum number of lines per page is 255.

```
10 'Set Vertical Motion Index
20 '
30 FOR I = 1 TO 15
40    READ D$
50    LPRINT CHR$(&H1B);CHR$(&H41);
             CHR$(VAL("&H"+D$))    ;CHR$(&H1B);CHR$(&H32);
60    LPRINT "SET VERTICAL MOTION INDEX";I
70 NEXT I
80 '
90 END
100 '
110 DATA 00,01,02,03,04,05,06,07,08,09,0A,0B,0C,0D,0E,
```

```
SET VERTICAL MOTION INDEX 1
SET VERTICAL MOTION INDEX 2
SET VERTICAL MOTION INDEX 3
SET VERTICAL MOTION INDEX 4
SET VERTICAL MOTION INDEX 5
SET VERTICAL MOTION INDEX 6
SET VERTICAL MOTION INDEX 7
SET VERTICAL MOTION INDEX 8
SET VERTICAL MOTION INDEX 9
SET VERTICAL MOTION INDEX 10
SET VERTICAL MOTION INDEX 11
SET VERTICAL MOTION INDEX 12
SET VERTICAL MOTION INDEX 13
SET VERTICAL MOTION INDEX 14
SET VERTICAL MOTION INDEX 15
```

ESC B(n1) (n2) (n... nk)NUL

Vertical Tabs

ESC B(n1)(n2)(n...nk)NUL sets vertical tabs and clears those previously set. The value of n is the line number where the tab position is set. The value of k is the number of vertical tabs (168 maximum).

Vertical tabs are set continuously until the NUL code is received. If more than 168 tabs are set, the command is automatically terminated and a NUL code is not needed.

ESC B NUL clears previously set tab stops.

```
10 'Set Vertical Tab
20 '
30 LPRINT CHR$(&H1B);CHR$(&H42);
          CHR$(&H3) ;CHR$(&H5) ;CHR$(&HA);CHR$(&H0);
40 '
50 FOR I = 1 TO 3
60    LPRINT CHR$(&HB);
70    LPRINT "Set Vertical Tab !"
80 NEXT I
90 '
100 END
```

```
Set Vertical Tab !

Set Vertical Tab !



Set Vertical Tab !
```

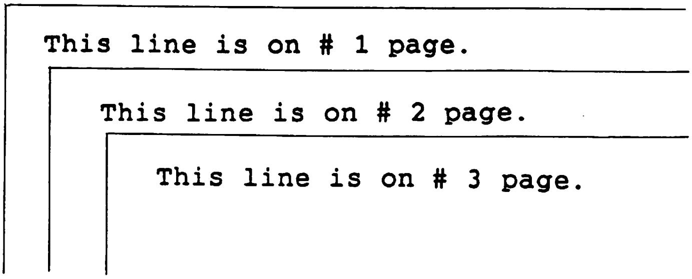
ESC C(n)

Lines Per Page

ESC C(n) sets the number of lines per page according to n. The value of n ranges from 01 to FF (hex).

If the number of lines is set beyond the paper length, the command is ignored and "Paper Size Error" appears on the control panel display. If print data remains in the buffer, the paper is ejected and the print position returns to top–of form (TOF). If no print data remains, the print position moves to TOF without the paper being ejected.

```
10 'Set Lines per page to (n)
20 '
30 'Set lines per page to 1
40 LPRINT CHR$(&H1B);CHR$(&H43);CHR$(&H1);
50 FOR I = 1 TO 3
60    LPRINT "This line is on #";I;"page."
70 NEXT I
80 '
90 END
```



```
This line is on # 1 page.
This line is on # 2 page.
This line is on # 3 page.
```

ESC D(n1)(n2)(n...nk)NUL

Horizontal Tabs

ESC D(n1)(n2)(n...nk)NUL sets horizontal tab positions and clears those previously set. The value of n is the column where the tab position is set. The value of k is the number of tab stop positions (maximum 240).

Horizontal tabs are set continuously until the NUL code is received. If more than 240 tabs are set, the command is automatically terminated and a NUL code is not needed.

ESC D NUL clears previously set tabs.

This code is not affected by double space mode or offset mode.

```
10 'Set Horizontal Tab
20 '
30 LPRINT ".........1.........2.........3.........4"
40 '
50 'Set horizontal tab
60 LPRINT CHR$(&H1B);CHR$(&H44);

          CHR$(&H5) ;CHR$(&HF) ;CHR$(&H1E);CHR$(&H0);
70 '
80 FOR I = 1 TO 3
90    LPRINT CHR$(&H9);
100   LPRINT "Set HT !";
110 NEXT I
120 '
130 END
```

```
.........1.........2.........3.........4
    Set HT !  Set HT !       Set HT !
```

ESC E

Auto Bold (Double-Strike) Set

ESC E sets auto bold (double-strike) printing. A character is printed once, the print position shifts upward by two dots, and the character is printed again.

Auto bold does not work with auto underline. It can be used in conjunction with dot mesh and right-to-left printing.

```
10 'Bold Print ON/OFF
20 '
30 LPRINT CHR$(&H1B);CHR$(&H45);
40 LPRINT "Bold Print ON"
50 '
60 'Bold Printing & Angular Magnification
70 LPRINT CHR$(&H1B);CHR$(&H45);
80 LPRINT CHR$(&H1C);CHR$(&H2B);CHR$(&H63)
90 LPRINT "Bold Print ON"
100 '
110 'Cancel Magnification
120 LPRINT CHR$(&H1C);CHR$(&H2B);CHR$(&H7A);
130 LPRINT "Bold Print OFF"
140 '
150 END
```

```
Bold Print ON
Bold Print ON
Bold Print OFF
```

ESC F

Auto Bold Cancel

ESC F cancels the auto bold mode. This mode is also cancelled by the following codes.

ESC &	Exits all word processing modes.
ESC G	Sets shadow mode.
CR	Sends carriage return. Includes carriage return sent by LF, VT, or FF codes.

The bold print mode cannot be cancelled by the auto return mode.

```
LPRINT CHR$(&H1B);CHR$(&H46)
```

ESC G

Auto Shadow Set

ESC G sets automatic shadow printing. A character is printed once, the print position shifts to the right by two dots, and the character is printed again.

Auto shadow does not work with auto underline. It can be used in conjunction with dot mesh and right-to-left printing.

```
10 'Shadow Print ON/OFF
20 '
30 LPRINT CHR$(&H1B);CHR$(&H47);
40 LPRINT "Shadow Print ON"
50 LPRINT
60 '
70 'Shadow Printing & Angular Magnification
80 LPRINT CHR$(&H1B);CHR$(&H47);
90 LPRINT CHR$(&H1C);CHR$(&H2B);CHR$(&H63);
100 LPRINT "Shadow Print ON"
110 '
120 'Cancel Magnification
130 LPRINT CHR$(&H1C);CHR$(&H2B);CHR$(&H7A);
140 LPRINT "Shadow Print OFF"
150 '
160 END
```

```
Shadow Print ON
Shadow Print ON
Shadow Print OFF
```

ESC H

Auto Shadow Cancel

ESC H cancels the auto shadow mode. The following codes also cancel this mode.

ESC &	Exits all word processing modes.
ESC E	Sets auto bold mode.
CR	Sends carriage return. Includes carriage return by LF, VT, or FF code.

The auto shadow mode cannot be cancelled by the auto return mode.

LPRINT CHR$(&H1B);CHR$(&H48)

ESC I

12 cpi

ESC I sets the 12 cpi mode. This command clears all pitch modes specified by the following ESC sequences.

ESC]# (HMI)
ESC S (10 cpi)
ESC SI (17 cpi)
SI (17 cpi)
ESC SO (double space)
SO (double space)

```
10 'Set Space Pitch 12 CPI
20 '
30 LPRINT "Normal Spacing Pitch !"
40 LPRINT
50 '
60 LPRINT CHR$(&H1B);CHR$(&H49);
70 LPRINT "Set Space Pitch 12 CPI !"
80 '
90 END
```

```
Normal Spacing Pitch !

Set Space Pitch 12 CPI !
```

ESC J

Right Margin Set

ESC J sets the current print position as the right margin. The print position cannot move beyond the right margin.

When auto return (SW1–10) is on and a code exceeding the right margin is received, an automatic return and line feed are performed.

This code is not effective in the raster graphics mode.

```
10 'Set Right Margin at current position
20 '
30 LPRINT ".........1.........2.........3........."
40 '
50 LPRINT SPACE$(&H14);
60 LPRINT CHR$(&H1B);CHR$(&H4A);
70 '
80 FOR I = 1 TO 3
90 LPRINT "* Set Right Margin at 20th column !";
100 NEXT I
110 '
120 LPRINT CHR$(&H1B);CHR$(&H4B)
130 '
140 END
```

```
.........1.........2.........3.........
                    *
 Set Right Margin at
20th column !* Set Ri
ght Margin at 20th co
lumn !* Set Right Mar
gin at 20th column !
```

ESC K

Right Margin Clear

ESC K clears the previously set right margin and sets it at the extreme right print position.

When auto return (SW1–10) is on and a code exceeding the right margin is received, an automatic return and line feed are performed.

LPRINT CHR$(&H1B);CHR$(&H4B)

ESC L

Program Mode Cancel

ESC L cancels the program mode. The program mode can also be cancelled by ESC &, ESC R, ESC $A, ESC 5, and ESC $B.

```
10 'Program Mode ON/OFF
20 '
30 LPRINT CHR$(&H1B);CHR$(&H50);
40 '
50 LPRINT CHR$(&H53);CHR$(&HA);CHR$(&H45);CHR$(&HB);
60 LPRINT CHR$(&H54);CHR$(&HF);CHR$(&H50);CHR$(&HF);
70 LPRINT CHR$(&H52);CHR$(&HF);CHR$(&H4F);CHR$(&HF);
80 LPRINT CHR$(&H47);CHR$(&HF);CHR$(&H52);CHR$(&HF);
90 LPRINT CHR$(&H41);CHR$(&HF);CHR$(&H4D);CHR$(&HF);
100 LPRINT CHR$(&H4D);CHR$(&HC);CHR$(&H4F);CHR$(&HD);
110 LPRINT CHR$(&H44);CHR$(&HE);CHR$(&H45);CHR$(&HF);
120 LPRINT CHR$(&H21)
130 '
140 LPRINT CHR$(&H1B);CHR$(&H4C)
150 '
160 END
```

```
SET PROGRAMMODE !
```

ESC M

Left Margin Set

ESC M sets the current print position as the left margin. The print position cannot move beyond this point.

This code is not effective in the raster graphics mode.

```
10 'Set Left Margin at current position
20 '
30 LPRINT ".........1.........2.........3........."
40 '
50 LPRINT SPACE$(&HA);
60 LPRINT CHR$(&H1B);CHR$(&H4D);
70 '
80 FOR I = 1 TO 3
90 LPRINT "* Set Left Margin at 10th column !"
100 NEXT I
110 '
120 LPRINT CHR$(&H1B);CHR$(&H4F)
130 '
140 END
```

```
.........1.........2.........3.........
          * Set Left Margin at 10th column !
          * Set Left Margin at 10th column !
          * Set Left Margin at 10th column !
```

ESC O

Left Margin Clear

ESC O clears the left margin setting and sets the left margin at the extreme left print position.

LPRINT CHR$(&H1B);CHR$(&H4F)

ESC P

Program Mode Set

ESC P sets the program mode. The printer enters a proportional spacing mode which is directed by the host CPU. This mode specifies the spacing of each character.

Figure 5–1 shows the data for a 2–byte command.

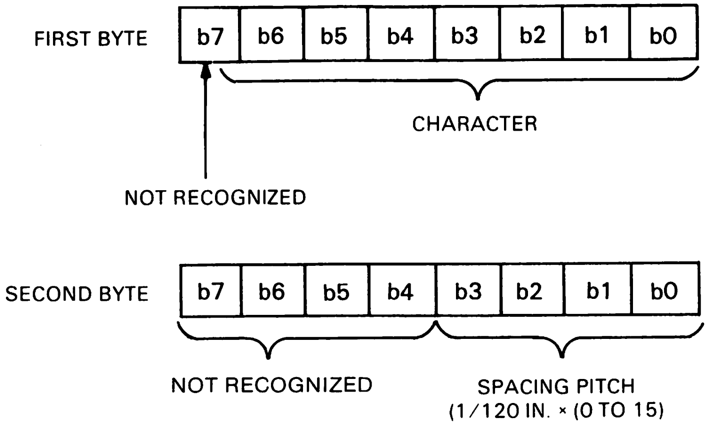


Figure 5–1 Program Mode Data

When the first byte is the SP code, all seven bits (0 to 6) of the second byte specify the amount of spacing (1 to 127 pitches).

Codes 20 through 7E (hex) process the code that follows the SP code as the bit pattern for specifying the amount of spacing used to print a character with a pair of bytes.

When a BS code is received in program mode, the printer moves the current print position backward by the amount of spacing specified for the character previously received. (This applies to continuous backspacing.)

See ESC L for a sample BASIC program.

ESC Q

Fine Backspace

ESC Q moves the print position 1/120 in. to the left. With right-to-left printing, ESC Q moves the print position to the right. The print position cannot go beyond the right or left margin.

This code does not affect HMI or the graphics mode.

```
LPRINT CHR$(&H1B);CHR$(&H51)
```

ESC R

Automatic Proportional Spacing Set

ESC R turns off the pitch selection mode. The spacing pitch is defined by the value coming from the font. The backspace (BS) code uses the previously set spacing pitch.

This code is ignored when a fixed pitch font is selected.

The proportional spacing mode can be used with right-to-left printing.

```
LPRINT CHR$(&H1B);CHR$(&H52)
```

ESC S

10 cpi

ESC S sets the 10 cpi mode. This code clears all pitches set by the following ESC sequences.

- ESC]# (HMI)
- ESC I (12 cpi)
- ESC SI (17 cpi)
- SI (17 cpi)
- ESC SO (double space)
- SO (double space)

```
10 'Set Space Pitch 10 CPI
20 '
30 LPRINT "Normal Spacing Pitch !"
40 LPRINT
50 '
60 LPRINT CHR$(&H1B);CHR$(&H53);
70 LPRINT "Set Space Pitch 10 CPI !"
80 '
90 END
```

```
Normal Spacing Pitch !

Set Space Pitch 10 CPI !
```

ESC T

Automatic Proportional Spacing Cancelled

ESC T cancels automatic proportional spacing and turns on the pitch selection mode.

LPRINT CHR$(&H1B);CHR$(&H54)

ESC U(n)

Left Margin Set by Column

ESC U(n) sets the left margin at the n(th) column. The value of n ranges from 1 to 255. The default value is column one.

```
10 'Set Left Margin at (n)th Column
20 '
30 LPRINT ".........1.........2.........3.........4"
40 '
50 LPRINT CHR$(&H1B);CHR$(&H55);CHR$(&HA)
60 '
70 LPRINT "For example,"
80 LPRINT "set left margin at 10th column"
90 LPRINT "until reset !"
100 '
110 END
```

```
.........1.........2.........3.........4

         For example,
         set left margin at 10th column
         until reset !"
```

ESC W(n)

Right Margin Set by Column

ESC W(n) sets the right margin at the (n)th column. The value of n ranges from 1 to 255. The printer defaults to the extreme right print position.

```
10 'Set Right Margin at (n)th Column
20 '
30 LPRINT ".........1.........2.........3..........4"
40 '
50 LPRINT CHR$(&H1B);CHR$(&H57);CHR$(&H14)
60 '
70 LPRINT "For example,";
80 LPRINT " set right margin at 20th column";
90 LPRINT " until reset";
100 '
110 END
```

```
.........1.........2.........3..........4

For example, set rig
ht margin at 20th co
lumn until reset
```

ESC Y

Right-to-Left Printing Cancel

ESC Y cancels right-to-left printing.

LPRINT CHR$(&H1B);CHR$(&H59)

ESC Z

Right–to–Left Printing Set

ESC Z causes the printer to print from right to left. This cancels the auto–return function. The HT and LF codes are not affected, and proportional spacing functions in the same manner as normal printing.

Font selection is prohibited in the right–to–left printing mode.

```
10 'Enable Backward Printing Mode
20 '
30 LPRINT SPACE$(30);'start at 30th column
40 LPRINT CHR$(&H1B);CHR$(&H5A);
50 LPRINT "Backward Printing Mode is set."
60 '
70 LPRINT CHR$(&H1B);CHR$(&H59);'clear Backward Printing Mode
80 LPRINT "It is cleared."
90 LPRINT
100 '
110 LPRINT "          Printing Mode is set.";
120 FOR I = 1 TO 23
130    LPRINT CHR$(&H8);'Back Space
140 NEXT I
150 '
160 LPRINT CHR$(&H1B);CHR$(&H5A);
170 LPRINT "DRAWKCAB"
180 '
190 END
```

```
 .tes si edoM gnitnirP drawkcaB
It is cleared.

BACKWARD Printing Mode is set.
```

ESC SO

Double Spacing

ESC SO sets double spacing and clears all pitch modes previously set by the following ESC sequences.

- ESC]# (HMI)
- ESC S (10 cpi)
- ESC I (12 cpi)
- ESC SI (17 cpi)
- SI (17 cpi)

ESC SO performs the same function as the SO control code.

```
10 'Double Space Mode ON
20 '
30 LPRINT "Normal Spacing Pitch !"
40 LPRINT
50 '
60 LPRINT CHR$(&H1B);CHR$(&HE);
70 LPRINT "Double Space Mode ON !"
80 '
90 'clear double space mode
100 LPRINT CHR$(&H1B);CHR$(&H3D)
110 '
120 END
```

```
Normal Spacing Pitch !

D o u b l e   S p a c e   M o d e   O N   !
```

ESC SI

17 cpi

ESC SI sets the pitch at 17 cpi and clears all pitch modes previously set by the following ESC sequences.

- ESC]# (HMI)
- ESC S (10 cpi)
- ESC SO (double space)
- SO (double space)

ESC SI performs the same function as the SI control code.

NOTE: Do not use this command with 10 cpi fonts as crowding may occur.

```
10 'Set Space Pitch 17 CPI
20 '
30 LPRINT "Normal Spacing Pitch !"
40 LPRINT
50 '
60 LPRINT CHR$(&H1B);CHR$(&HF);
70 LPRINT "Set Space Pitch 17 CPI !"
80 '
90 END
```

```
Normal Spacing Pitch !

Set Space Pitch 17 CPI !
```

ESC &

Cancellation Mode

- ESC & cancels the following modes
- ESC - (auto underscore)
- ESC E (auto bold)
- ESC G (auto shadow)
- ESC % (offset selection)
- ESC $B (auto justification)
- ESC $A (auto centering)
- ESC P (program mode)
- ESC . (graphics mode)
- ESC Z (right-to-left printing)
- FS ,(α) (screen printing)
- FS +(α) (magnification mode)

```
LPRINT CHR$(&H1B);CHR$(&H26)
```

ESC '

Auto Underscore Clear

ESC ' clears the underscore mode after adding the underscore. ESC & also cancels this mode but does not add the underscore.

```
10 'Auto Underscore Mode ON/OFF
20 '
30 LPRINT CHR$(&H1B);CHR$(&H2D);
40 LPRINT "Auto Underscore Mode ON !"
50 LPRINT
60 '
70 'Angular Magnification
80 LPRINT CHR$(&H1C);CHR$(&H2B);CHR$(&H63);
90 LPRINT "Angular Magnification !"
100 LPRINT CHR$(&H1C);CHR$(&H2B);CHR$(&H7A);
110 LPRINT
120 '
130 'Script Character Selection
140 LPRINT "Foot Note References";
150 LPRINT CHR$(&H1C);CHR$(&H21);CHR$(&H61);
160 LPRINT "1";"2";
170 LPRINT CHR$(&H1C);CHR$(&H21);CHR$(&H7A)
180 LPRINT
190 '
200 LPRINT "Mathematical  Equation = X";
210 LPRINT CHR$(&H1C);CHR$(&H21);CHR$(&H62);
220 LPRINT "3";"4";
230 LPRINT CHR$(&H1C);CHR$(&H21);CHR$(&H7A)
240 LPRINT
250 '
260 LPRINT CHR$(&H1B);CHR$(&H27);
270 LPRINT "Auto Underscore Mode OFF !"
280 '
290 END
```

```
Auto Underscore Mode ON !
Angular Magnification !

Foot Note References12

Mathematical  Equation = X34

Auto Underscore Mode OFF !
```

ESC +

ROM Table Select

ESC + selects the ROM table and cancels RAM table select. Unless otherwise specified, spacing pitch is 10 cpi and line feed pitch is 6 lpi.

ESC -

Auto Underscore Set

ESC - automatically adds an underscore after printing. When this mode is set, the current print position is the start position. Print data is then received until the auto underscore mode is cancelled by ESC '. The end position is the last position before the mode is cancelled.

A print code or SP code must be received between the start and end position in order to print the underscore. With a half–line feed or reverse half–line feed, the end position is not set.

When a CR, LF, VT, FF, reverse line feed, or auto return code is received, the underscore moves to the next line.

See ESC ' for a programming example.

ESC .

Graphics Mode Set

ESC . sets the graphics mode when the option board is installed. The graphics mode provides a basic means of charting, graphing, and plotting. It does, however, rely entirely on the host system software for control.

In the graphics mode, all horizontal spacing and backspacing codes perform a 1/60–in. spacing operation. The LF, ESC 7, and auto return codes perform a 1/48–in. line feed.

ESC . cancels the following commands.

- ESC & (cancel WP mode)
- CR (carriage return)
- ESC R (proportional spacing mode)
- ESC 5 (RAM table select mode)
- ESC $A (auto centering)
- ESC $B (auto justification)
- ESC P (set program mode)
- ESC L (cancel program mode)

LPRINT CHR$(&H1B);CHR$(&H2E)

ESC /

Graphics Mode Clear

ESC / clears the graphics mode.

LPRINT CHR$(&H1B);CHR$(&H2F)

ESC :

Half-Line Feed

ESC : causes the paper to advance one half-line feed. This function is effective only for 6 lpi and 8 lpi spacing. The half-line feed is not followed by an automatic carriage return.

A new line management becomes necessary whenever ESC : is received. The window covers 150 dots above and 100 dots below the print reference position. When a half-line feed is performed repeatedly, underscoring is carried out along the print reference position. However, if the window overflows, a half-line feed occurs and the print reference position shifts accordingly. As a result, the underscore position also shifts.

```
10 'PERFORM HALF-LINE FEED
20 '
30 LPRINT CHR$(&H1B);CHR$(&H2D);'auto underscore on
40 '
50 LPRINT "PERFORM";
60 '
70 FOR I = 1 TO 5
80 LPRINT CHR$(&H1B);CHR$(&H3A);
90 LPRINT " 1/2 LF";I;
100 NEXT I
110 '
120 LPRINT CHR$(&H1B);CHR$(&H27);'auto underscore off
130 '
140 END
```

```
PERFORM 1/2 LF 1
                  1/2 LF 2
                           1/2 LF 3
                                    1/2 LF 4
                                             1/2 LF 5
```

ESC ; Reverse Half-Line Feed

ESC ; causes the printer to perform a reverse half-line feed. This function is effective only for 6 lpi and 8 lpi spacing. The reverse half-line feed is not followed by an automatic carriage return.

A new line management becomes necessary whenever ESC : is received. The window covers 150 dots above and 100 dots below the print reference position. When a half-line feed is performed repeatedly, underscoring is carried out along the print reference position. However, if the window overflows, a half-line feed occurs and the print reference position shifts accordingly. As a result, the underscore position also shifts.

```
10 'PERFORM NEGATIVE HALF-LINE FEED
20 '
30 LPRINT CHR$(&H1B);CHR$(&H2D);'auto underscore on
40 '
50 LPRINT "PERFORM";
60 '
70 FOR I = 1 TO 5
80 LPRINT CHR$(&H1B);CHR$(&H3B);
90 LPRINT " -1/2 LF";I;
100 NEXT I
110 '
120 LPRINT CHR$(&H1B);CHR$(&H27);'auto underscore off
130 '
140 END
```

```
                                                    -1/2 LF 5
                                         -1/2 LF 4
                              -1/2 LF 3
                   -1/2 LF 2
        -1/2 LF 1
PERFORM
```

ESC <

ESC > Cancel

ESC < causes SI and ESC SI to be ignored and cancels ESC >.

ESC =

Spacing and Line Pitch Clear

ESC = clears the spacing and line pitches to the initialized state. Spacing depends on the font. Line spacing is 6 lpi. HMI and double space modes are cancelled.

LPRINT CHR$(&H1B);CHR$(&H3D)

ESC >

ESC < Cancel

ESC > cancels ESC <.

LPRINT CHR$(&H1B);CHR$(&H3E)

ESC ?

RAM Table Loading Set

ESC ? sets up each 3 bytes of data in the RAM table after the RAM loading mode has been set. Figure 5-2 shows the RAM loading format, and Figure 5-3 shows the spacing pitch designation.

```
10 'RAM LOADING MODE SET
20 LPRINT CHR$(&H1B);CHR$(&H3F);
30 '
40 LPRINT CHR$(&H53);CHR$(&H0);CHR$(&H12);
50 LPRINT CHR$(&H65);CHR$(&H0);CHR$(&H13);
60 LPRINT CHR$(&H74);CHR$(&H0);CHR$(&H14);
70 LPRINT CHR$(&H20);CHR$(&H0);CHR$(&H15);
80 LPRINT CHR$(&H52);CHR$(&H0);CHR$(&H16);
90 LPRINT CHR$(&H41);CHR$(&H0);CHR$(&H17);
100 LPRINT CHR$(&H4D);CHR$(&H0);CHR$(&H18);
110 LPRINT CHR$(&H20);CHR$(&H0);CHR$(&H19);
120 LPRINT CHR$(&H6D);CHR$(&H0);CHR$(&H1A);
130 LPRINT CHR$(&H6F);CHR$(&H0);CHR$(&H1B);
140 LPRINT CHR$(&H64);CHR$(&H0);CHR$(&H1C);
150 LPRINT CHR$(&H65);CHR$(&H0);CHR$(&H1D);
160 LPRINT CHR$(&H20);CHR$(&H0);CHR$(&H1E);
170 LPRINT CHR$(&H21);CHR$(&H0);CHR$(&H1F);
180 '
190 'RAM LOADING MODE OFF
200 LPRINT CHR$(&H1B);CHR$(&H40);
210 '
220 'SELECT RAM MODE
230 LPRINT CHR$(&H1B);CHR$(&H35);
240 LPRINT "Set RAM mode !"
250 '
260 END
```

```
S  e    t    R   A   M    m   o   d   e    !
```

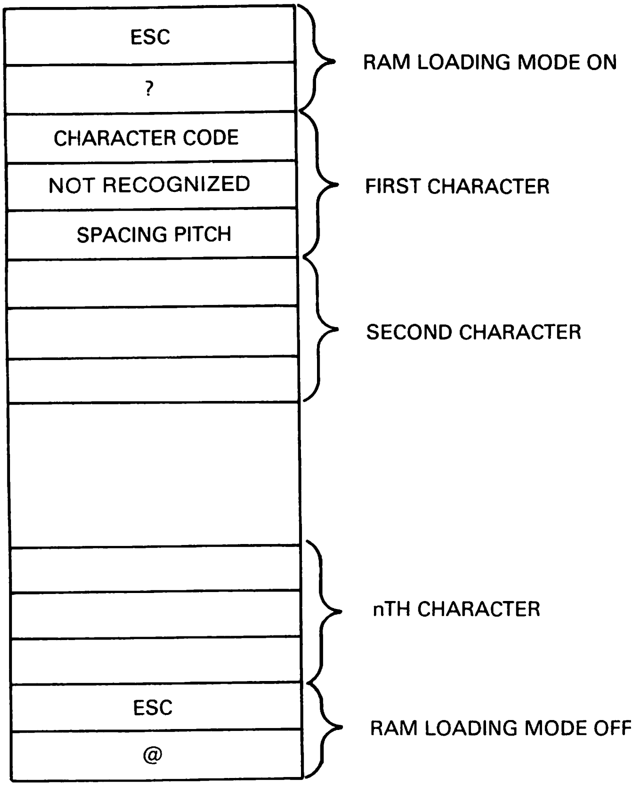


Figure 5–2 RAM Loading Format

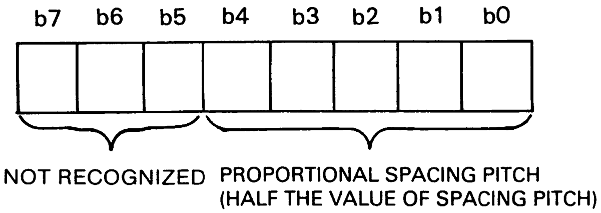


Figure 5–3 Spacing Pitch Designation

An STX or ETX code immediately before the character code in the RAM loading mode is valid. Control codes other than STX, ETX, or ESC @ are ignored.

The number of characters to be provided is not specified. The default value and RAM table indicate all zeros when the power supply is switched on.

The loaded RAM table is not cleared by the initializing command (ESC #A). It is cleared at initialization when the alarm releases.

LPRINT CHR$(&H1B);CHR$(&H3F)

ESC @

RAM Table Loading Cancel

ESC @ cancels the RAM table loading mode.

LPRINT CHR$(&H1B);CHR$(&H40)

ESC [

Auto Return and Line Spacing Cancel

ESC [cancels auto return and line spacing. When this sequence is in effect, the LF, VT, and FF codes are not followed by a carriage return. This state continues until the next power-on default or initialization.

LPRINT CHR$(&H1B);CHR$(&H5B)

ESC ^

Auto Return and Line Spacing Set

ESC ^ sets the auto return and line spacing mode. In this mode, the print position returns to the left margin when an LF, VT, or FF code is received. This mode continues until the next power-on default or initialization.

LPRINT CHR$(&H1B);CHR$(&H5E)

ESC #A

Initialization

ESC #A returns the printer to the power–on state. All printer characteristics are reset to the default values and the printer's data buffer is cleared.

Once the ESC #A command is received, initialization begins when a full line of data has been received. The Busy signal turns on and the printer prints out all received data.

Any of the following also initializes the printer.

- normal print mode
- VMI set to 6 lpi
- lines per page set to maximum
- black printing
- left margin cleared
- right margin cleared
- all horizontal and vertical tabs cleared
- all buffers cleared
- WP mode cleared

The following are not set to their default values at initialization.

- RAM loading table
- download characters
- form registration information
- font selection

LPRINT CHR$(&H1B);CHR$(&H23);
CHR$(&H41)

ESC $A

Auto Center

ESC $A sets automatic centering for one line of data and then cancels the mode. When auto center and auto justification are both specified, auto centering is performed first and then auto justification is set.

If a line begins or ends with a space or horizontal tab, the space and tab are included in the centering.

ESC P and ESC & cancel the auto center mode.

```
10  'ENABLE AUTO CENTER/AUTO JUSTIFY MODE
20 '
30 LPRINT ".........1.........2.........3.........4.........5"
40 '
50 'Enable Auto Justify
60 LPRINT CHR$(&H1B);CHR$(&H24);CHR$(&H42);
70 '
80 'set left/right margin
90 LPRINT CHR$(&H1B);CHR$(&H55);CHR$(&HA);
100 LPRINT CHR$(&H1B);CHR$(&H57);CHR$(&H2F);
110 '
120 'Enable Auto Center
130 LPRINT CHR$(&H1B);CHR$(&H24);CHR$(&H41);
140 LPRINT "Auto Center Mode ON"
150 LPRINT
160 '
170 LPRINT "After AUTO JUSTIFY mode has been set,"
180 LPRINT "the data is then PRINTED JUSTIFIED"
190 LPRINT "between the LEFT and RIGHT margin "
200 LPRINT "until get the sequence ESC &."
210 '
220 END
```

```
.........1.........2.........3.........4.........5
                  Auto Center Mode ON

         After AUTO JUSTIFY mode has been set,
         the  data  is  then  PRINTED  JUSTIFIED
         between  the  LEFT  and  RIGHT  margin
         u n t i l   g e t   t h e   s e q u e n c e   E S C   & .
```

ESC $B

Auto Justification

ESC $B sets the automatic justification mode. Character pitch is expanded or compressed in 1/120-in. units so that the last print position will end at the right margin.

Expansion and compression function in the following manner. When necessary, n/300 in. is added to the space between words until the space is 150% of its original size. At this point, n/300 in. is added to the space between characters. If n reaches its maximum value of 18 and the last character still does not reach the right margin, the line is printed without being justified. Compression is used only for space between words. When necessary, the space between words is reduced by n/300-in. units. When the space is 50% of its original size and the last character still does not reach the right margin, the line is printed without being justified.

Justification begins with the first print position after a carriage return or line feed, except when the first position is a space or horizontal tab. If the last print position is a space, the space is ignored unless it is underscored. Up to 251 characters can be stored for justification. When this limit is exceeded, the data is printed unjustified. SW1-10, Auto Return, must be off when compression justification is performed.

When the graphics mode is selected while the justification mode is in effect, the character pitch is not expanded.

Justification is not performed when a backspace (BS) code is preceded and followed by a print code.

ESC %<n1n2>

Spacing Offset

ESC %<n1n2> is used in special situations to control the amount of spacing offset between characters. Spacing offset is the amount of space that separates printed characters. Spacing is added or subtracted according to the value of <n1n2>.

Normally, the spacing pitch is changed through the HMI value. In the auto proportional mode, the spacing pitch is determined by the bearing value of each character. ESC % enables you to add to and subtract from the bearing value, thus changing the spacing pitch.

If the subtraction value is 0 or a negative number, the print position does not move.

When ESC % and the double spacing mode are used together, the offset amount applies to the double spacing amount.

```
10 'Offset Selection
20 '
30 FOR I = 1 TO 30
40    READ D$
50    LPRINT CHR$(&H1B);CHR$(&H25);CHR$(VAL("&H"+D$));
60    LPRINT "Offset Selection";I
70 NEXT I
80 '
90 END
100 '
110 DATA 50,51,52,53,54,55,56,57,58,59,5A,5B,5C,5D,5E,5F,
120 DATA 40,41,42,43,44,45,46,47,48,49,4A,4B,4C,4D,4E,4F,
```

```
Offset Selection 1
Offset Selection 2
Offset Selection 3
Offset Selection 4
Offset Selection 5
Offset Selection 6
Offset Selection 7
Offset Selection 8
Offset Selection 9
Offset Selection 10
Offset Selection 11
Offset Selection 12
[illegible]
[illegible]
[illegible]
[illegible]
Offset Selection 17
Offset Selection 18
Offset  Selection  19
O f f s e t  S e l e c t i o n  2 0
O f f s e t  S e l e c t i o n  2 1
O f f s e t   S e l e c t i o n   2 2
O f f s e t   S e l e c t i o n   2 3
O f f s e t   S e l e c t i o n   2 4
O  f  f  s  e  t   S  e  l  e  c  t  i  o  n   2  5
O  f  f  s  e  t   S  e  l  e  c  t  i  o  n   2  6
O  f  f  s  e  t   S  e  l  e  c  t  i  o  n   2  7
O  f  f  s  e  t   S  e  l  e  c  t  i  o  n   2  8
O  f  f  s  e  t   S  e  l  e  c  t  i  o  n   2  9
O  f  f  s  e  t   S  e  l  e  c  t  i  o  n   3  0
```

Figure 5–4 shows the offset amount in each byte of data.

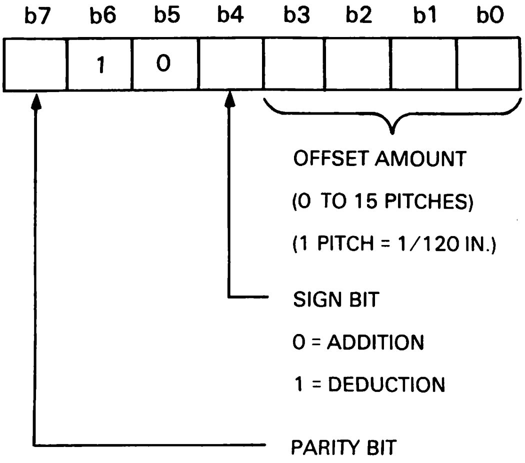


Figure 5–4 Spacing Offset

ESC \A

Hopper 1 Selected

ESC \A selects hopper 1 at power–on. If this command is received when the print position is in the middle of a page, the paper is ejected and hopper 1 becomes effective immediately.

```
LPRINT CHR$(&H1B);CHR$(&H5C);
CHR$(&H41)
```

ESC \B

Hopper 2 Selected

ESC \B selects the optional second hopper. If this command is received when the print position is in the middle of a page, the paper is ejected and hopper 2 becomes effective with the following page.

```
LPRINT CHR$(&H1B);CHR$(&H5C);
CHR$(&H42)
```

ESC]#
(@ to 0)

HMI Spacing

ESC]# sets the horizontal motion index at a value between 0 and 15/120 in. Spacing pitches and amount of spacing for SP and BS codes can be set in increments of 1/120 in. In the autoproportional spacing mode, the amount of spacing is specified by the SP or BS code.

This code cancels the following spacing pitches.

- ESC S (10 cpi)
- ESC I (12 cpi)
- ESC SI (17 cpi)
- SI (17 cpi)
- SO (double spacing)

Table 5–3 shows the ASCII characters and their corresponding HMI values.

Table 5–3 ASCII Characters and HMI Values

ASCII CHARACTER	HMI VALUE (INCHES)
@	0
A	1/120
B	2/120
C	3/120
D	4/120
E	5/120
F	6/120
G	7/120
H	8/120
I	9/120
J	10/120 (1/12)
K	11/120
L	12/120 (1/10)
M	13/120
N	14/120
O	15/120

```
10 'Set n/120-inch spacing pitch
20 '
30 FOR I = 1 TO 15
40    READ D$
50    LPRINT CHR$(&H1B);CHR$(&H5D);CHR$(VAL("&H"+D$));
60    LPRINT "n/120-inch spacing pitch !";
70    LPRINT CHR$(&H1B);CHR$(&H3D)
80 NEXT I
90 '
100 END
110 '
120 DATA 40,41,42,43,44,45,46,47,48,49,4A,4B,4C,4D,4E,4F
```

```
[illegible]
[illegible]
[illegible]
[illegible]
n/120-inchspacingpitch!
n/120-inchspacingpitch !
n/120-inch spacing pitch !
n/120-inch spacing pitch !
n/120-inch spacing pitch !
n/120-inch spacing pitch !
n/120-inch spacing pitch !
n/120-inch spacing pitch !
n/120-inch spacing pitch !
n/120-inch spacing pitch !
n/120-inch spacing pitch !
```

ESC ~a

Shift In

ESC ~a causes all the codes that follow to be regarded as shift-in codes until an ESC ~b code is received. This command is available in ASCII table 1 and in the 7-bit mode, but not in the 8-bit mode.

```
10 'SHIFT IN
20 '
30 'Select ASCII Table 1
40 LPRINT CHR$(&H1B);CHR$(&H7D);CHR$(&H61)
50 '
60 'Shift In
70 LPRINT CHR$(&H1B);CHR$(&H7E);CHR$(&H61);
80 LPRINT CHR$(&H40)
90 '
100 'Disable Shift In
110 LPRINT CHR$(&H1B);CHR$(&H7E);CHR$(&H7A)
120 '
130 'Select ASCII Table 2
140 LPRINT CHR$(&H1B);CHR$(&H7D);CHR$(&H62)
150 '
160 END
```

ESC ~b

Shift Out

ESC ~b causes all the codes that follow to be regarded as shift-out codes until an ESC ~b is received. This command is available in ASCII table 1 and in the 7-bit mode, but not in the 8-bit mode.

```
10 'SHIFT OUT
20 '
30 'Select ASCII Table 1
40 LPRINT CHR$(&H1B);CHR$(&H7D);CHR$(&H61)
50 '
60 'Shift In
70 LPRINT CHR$(&H1B);CHR$(&H7E);CHR$(&H62);
80 LPRINT CHR$(&HA0)
90 '
100 'Disable Shift Out
110 LPRINT CHR$(&H1B);CHR$(&H7E);CHR$(&H7A)
120 '
130 'Select ASCII Table 2
140 LPRINT CHR$(&H1B);CHR$(&H7D);CHR$(&H62)
150 '
160 END
```

ESC ~z

ESC ~a and ESC ~b Ignored

ESC ~z causes ESC ~a and ESC ~b to be ignored.

LPRINT CHR$(&H1B);CHR$(&H7E);
CHR$(&H7A)

ESC }a

ASCII Table 1 Select

ESC }a selects ASCII Table 1.

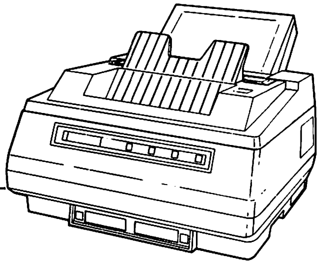
```
LPRINT CHR$(&H1B);CHR$(&H7D);
CHR$(&H61)
```

ESC }b

ASCII Table 2 Select

ESC }b selects ASCII Table 2.

```
LPRINT CHR$(&H1B);CHR$(&H7D);
CHR$(&H62)
```



Section 6

4201 IBM Proprinter Command Set

This section provides programming explanations and code descriptions for the 4201 IBM Proprinter command set. This command set can be selected by either setting SW1–2, located at the rear of the printer, to the on position, or by the form separator sequence FS C(α). The FS sequences, which are explained in Section 7, also work with the 4201 Proprinter command set.

This section is intended for users who write their own programs, and assumes some knowledge of BASIC programming. Users who do not write programs but depend on preprogrammed applications packages can skip this section completely, or read it for insight into how the printer works.

ASCII CODING

Tables 6–1 through 6–3 list the ASCII codes that can be used to control the printer. ESC 7 selects Character Set 1, and ESC 6 selects Character Set 2. You may also print from the All Characters Chart using ESC \(n1)(n2) or ESC ^. The bold 0 to F numbers on the top and left side are the hexadecimal (hex) numbers for the alphanumeric, special, and graphics characters inside the boxes. The numbers inside the boxes, underneath the characters, are decimal equivalents of the hex numbers for these characters.

Programming ASCII Characters

To print ASCII character "A" from the table, use the ASCII A, its decimal equivalent, 65, or its hex equivalent, 41 (column 4, row 1). In BASIC you could use any of the following.

- LPRINT "A"
- LPRINT CHR$(65)
- LPRINT CHR$(&H41)

The preceding examples were for an uppercase "A". For a lowercase "a", the decimal equivalent is 97, not 65. The hex equivalent is 61, not 41. The following examples print a lowercase "a".

- LPRINT "a"
- LPRINT CHR$(97)
- LPRINT CHR$(&H61)

Table 6–1 ASCII Codes for Character Set 1 (Standard)

SECOND HEX DIGIT	FIRST HEX DIGIT															
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**
0	NUL 00	16	SP 32	0 48	@ 64	P 80	\ 96	p 112	NUL 128	144	á 160	░ 176	└ 192	┴ 208	α 224	≡ 240
1	01	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	129	DC1 145	í 161	▒ 177	┴ 193	┬ 209	β 225	± 241
2	STX 02	DC2 18	″ 34	2 50	B 66	R 82	b 98	r 114	STX 130	DC2 146	ó 162	▓ 178	┬ 194	┬ 210	T 226	≥ 242
3	ETX 03	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115	ETX 131	DC3 147	ú 163	│ 179	├ 195	└ 211	π 227	≤ 243
4	04	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	132	DC4 148	ñ 164	┤ 180	─ 196	└ 212	Σ 228	⌠ 244
5	05	§ 21	% 37	5 53	E 69	U 85	e 101	u 117	133	§ 149	Ñ 165	┤ 181	┼ 197	┌ 213	σ 229	⌡ 245
6	06	22	& 38	6 54	F 70	V 86	f 102	v 118	134	150	a̲ 166	┤ 182	├ 198	┌ 214	μ 230	÷ 246
7	BEL 07	23	’ 39	7 55	G 71	W 87	g 103	w 119	BEL 135	151	o̲ 167	┐ 183	├ 199	┼ 215	τ 231	≈ 247
8	08	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	136	CAN 152	¿ 168	┐ 184	└ 200	┼ 216	Φ 232	° 248
9	HT 09	25	) 41	9 57	I 73	Y 89	i 105	y 121	HT 137	153	⌐ 169	┤ 185	┌ 201	┘ 217	Θ 233	■ 249
A	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	LF 138	154	¬ 170	│ 186	┴ 202	┌ 218	Ω 234	– 250
B	11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	139	ESC 155	½ 171	┐ 187	┬ 203	█ 219	δ 235	√ 251
C	FF 12	FS 28	, 44	< 60	L 76	\ 92	l 108	¦ 124	FF 140	FS 156	¼ 172	┘ 188	├ 204	■ 220	∞ 236	η 252
D	CR 13	29	— 45	= 61	M 77	] 93	m 109	} 125	CR 141	157	¡ 173	┘ 189	─ 205	▌ 221	φ 237	² 253
E	SO 14	30	. 46	> 62	N 78	≙ 94	n 110	~ 126	SO 142	158	≪ 174	┘ 190	┼ 206	▐ 222	ε 238	■ 254
F	SI 15	US 31	/ 47	? 63	O 79	_ 95	o 111	127	SI 143	US 159	≫ 175	┐ 191	┴ 207	■ 223	∩ 239	255

Table 6–2 ASCII Codes for Character Set 2 (IBM)

SECOND HEX DIGIT	**FIRST HEX DIGIT**															
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**
0	NUL 00	16	SP 32	0 48	@ 64	P 80	\\ 96	p 112	Ç 128	É 144	á 160	░ 176	└ 192	┴ 208	α 224	≡ 240
1	01	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	ü 129	æ 145	í 161	▒ 177	┴ 193	┬ 209	β 225	± 241
2	02	DC2 18	″ 34	2 50	B 66	R 82	b 98	r 114	é 130	Æ 146	ó 162	▓ 178	┬ 194	┬ 210	Τ 226	≥ 242
3	♥ 03	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	│ 179	├ 195	└ 211	π 227	≤ 243
4	◆ 04	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	ä 132	ö 148	ñ 164	┤ 180	─ 196	└ 212	Σ 228	⌠ 244
5	♣ 05	§ 21	% 37	5 53	E 69	U 85	e 101	u 117	à 133	ò 149	Ñ 165	┤ 181	┼ 197	┌ 213	σ 229	⌡ 245
6	♠ 06	22	& 38	6 54	F 70	V 86	f 102	v 118	å 134	û 150	ª 166	┤ 182	├ 198	┌ 214	μ 230	÷ 246
7	BEL 07	23	’ 39	7 55	G 71	W 87	g 103	w 119	ç 135	ù 151	º 167	┐ 183	├ 199	┼ 215	τ 231	≈ 247
8	08	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	ê 136	ÿ 152	¿ 168	┐ 184	└ 200	┼ 216	Φ 232	° 248
9	HT 09	25	) 41	9 57	I 73	Y 89	i 105	y 121	ë 137	Ö 153	⌐ 169	┤ 185	┌ 201	┘ 217	Θ 233	■ 249
A	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	è 138	Ü 154	¬ 170	│ 186	┴ 202	┌ 218	Ω 234	— 250
B	11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	ï 139	¢ 155	½ 171	┐ 187	┬ 203	█ 219	δ 235	√ 251
C	FF 12	28	, 44	< 60	L 76	\\ 92	l 108	¦ 124	î 140	£ 156	¼ 172	┘ 188	├ 204	▄ 220	∞ 236	η 252
D	CR 13	29	— 45	= 61	M 77	] 93	m 109	} 125	ì 141	¥ 157	¡ 173	┘ 189	─ 205	▌ 221	ϕ 237	² 253
E	SO 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	Ä 142	₧ 158	« 174	┘ 190	┼ 206	▐ 222	ε 238	■ 254
F	SI 15	US 31	/ 47	? 63	O 79	_ 95	o 111	127	Å 143	ƒ 159	» 175	┐ 191	┴ 207	▀ 223	∩ 239	255

Table 6–3 ASCII Codes for All Characters Chart

SECOND HEX DIGIT	FIRST HEX DIGIT															
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**
0	00	16	SP 32	0 48	@ 64	P 80	\\ 96	p 112	Ç 128	É 144	á 160	░ 176	└ 192	╨ 208	α 224	≡ 240
1	01	17	! 33	1 49	A 65	Q 81	a 97	q 113	ü 129	æ 145	í 161	▒ 177	┴ 193	╤ 209	β 225	± 241
2	02	18	″ 34	2 50	B 66	R 82	b 98	r 114	é 130	Æ 146	ó 162	▓ 178	┬ 194	╥ 210	T 226	≥ 242
3	♥ 03	19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243
4	♦ 04	η 20	$ 36	4 52	D 68	T 84	d 100	t 116	ä 132	ö 148	ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244
5	♣ 05	§ 21	% 37	5 53	E 69	U 85	e 101	u 117	à 133	ò 149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
6	♠ 06	22	& 38	6 54	F 70	V 86	f 102	v 118	ȧ 134	û 150	a̲ 166	╢ 182	╞ 198	╓ 214	μ 230	÷ 246
7	07	23	’ 39	7 55	G 71	W 87	g 103	w 119	ç 135	ù 151	o̲ 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247
8	08	24	(40	8 56	H 72	X 88	h 104	x 120	ê 136	ÿ 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248
9	09	25	) 41	9 57	I 73	Y 89	i 105	y 121	ë 137	Ö 153	⌐ 169	╣ 185	╔ 201	┘ 217	Θ 233	○ 249
A	10	→ 26	* 42	: 58	J 74	Z 90	j 106	z 122	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	● 250
B	11	← 27	+ 43	; 59	K 75	[91	k 107	{ 123	ï 139	¢ 155	½ 171	╗ 187	╦ 203	█ 219	δ 235	√ 251
C	12	28	, 44	< 60	L 76	\\ 92	l 108	¦ 124	î 140	£ 156	¼ 172	╝ 188	╠ 204	■ 220	∞ 236	η 252
D	13	29	— 45	= 61	M 77	] 93	m 109	} 125	ì 141	¥ 157	¡ 173	╜ 189	═ 205	▌ 221	φ 237	^{2} 253
E	14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	Ä 142	₧ 158	≪ 174	╛ 190	╬ 206	▐ 222	ε 238	■ 254
F	15	Ø 31	47	? 63	O 79	_ 95	o 111	127	Ȧ 143	ƒ 159	≫ 175	┐ 191	╧ 207	■ 223	∩ 239	SP 255

Programming Control Codes

Control codes are nonprintable ASCII codes that control various printer functions. To send a control code to the printer in a BASIC program, use the hexadecimal or decimal value of the code you want. For example, LPRINT CHR$(x), where x is the decimal or hex equivalent of the control code you want, sends the code to the printer. Thus,

```
LPRINT CHR$(13)
```

sends a carriage return code to the printer. CHR$(13) is the decimal of the carriage return control code.

Control codes are always sent using their decimal or hexadecimal equivalents. For example, here are correct and incorrect ways to send a form feed control code.

Incorrect:	LPRINT "FF"
Correct (decimal form):	LPRINT CHR$(12)
Correct (hex form):	LPRINT CHR$(&H0C)

Programming Escape (ESC) Sequences

Escape sequences are combinations of the ESC control code and control characters. They are used to program various functions such as tabs, forms length, or margins. An escape sequence always consists of the ESC control code followed by one or more characters.

For example, to program ESC A, you have three choices.

ASCII character form:	LPRINT CHR$(27);"A"
Decimal form:	LPRINT CHR$(27);CHR$(65)
Hex form:	LPRINT CHR$(H1B);CHR$(&H41)

In this guide, ESC A(n) indicates that (n) is a numeric (decimal or hex) value.

Programming Form Separator (FS) Sequences

Form separator (FS) sequences consist of the FS control code followed by one or more control characters.

For example, to program FS R, you could use any of the following.

- ASCII character form: LPRINT CHR$(28);“R”
- Decimal form: LPRINT CHR$(28);CHR$(82)
- Hex form: LPRINT CHR$(&H1C);CHR$(&H52)

See Section 7 for a complete explanation of FS sequences.

CONTROL CODES

The following is an explanation of each IBM Proprinter command set control code. A sample BASIC programming line is included for each code.

See Appendix A for a quick reference to these control codes.

NUL	**Null** The printer ignores a NUL control code. LPRINT CHR$(&H00)
BEL	**Bell** BEL sounds the printer’s buzzer for approximately 1 second. LPRINT CHR$(&H07)
BS	**Backspace** BS moves the print position one character space to the left. Exact movement of the print position is determined by current character spacing. If the current print position is at the first print position, this command is ignored. LPRINT CHR$(&H08)

HT

Horizontal Tab

HT advances the print position to the next horizontal tab. See ESC D to set horizontal tabs.

At power-on, tabs are set at every eighth column, beginning with column 9.

```
LPRINT CHR$(&H09)
```

LF

Line Feed

LF advances the print position to the next line. IF SW2-1 is on, LF causes the printer to perform an automatic carriage return.

```
LPRINT CHR$(&H0A)
```

VT

Vertical Tab

VT advances the print position to the next vertical tab. See ESC B to set vertical tabs.

If SW2-1 is on, VT causes the printer to do an automatic carriage return. If no vertical tab is set between the current position and the next top-of-form, the print position advances one line. If no vertical tabs are set at all, the VT code advances the print position one line.

```
LPRINT CHR$(&H0B)
```

FF

Form Feed

FF advances the paper to the next top-of-form and performs a carriage return.

```
LPRINT CHR$(&H0C)
```

CR

Carriage Return

CR returns the print position to the left margin. No line feed occurs unless

- SW2-6 is on, or
- the printer receives ESC 5(1) (automatic line feed mode set).

LPRINT CHR$(&H0D)

SO

Elongated Printing by Line

SO prints each character at twice the current width. This results in half as many characters per inch. SO is cancelled by the following codes:

CR	DC4
CAN	VT
LF	ESC W
FF	

LPRINT CHR$(&H0E)

SI

Condensed Printing

SI sets the condensed printing mode. Character spacing is 17.1 characters per inch (cpi). DC2 cancels condensed printing and returns spacing to 10 cpi.

LPRINT CHR$(&H0F)

NOTE: Do not use this command with 10 cpi fonts as crowding may occur.

DC1

Select Printer

DC1 sets the printer up to accept data from the computer.

LPRINT CHR$(&H11)

DC2	**10 cpi Printing** DC2 selects the 10 cpi printing mode. This command cancels 12 cpi and condensed printing, but not elongated printing. LPRINT CHR$(&H12)
DC3	**Deselect Printer** The printer ignores a DC3 control code. LPRINT CHR$(&H13)
DC4	**Cancel Elongated Printing by Line** DC4 cancels the elongated printing mode (started by SO) and returns the printer to the previous printing mode. LPRINT CHR$(&H14)
CAN	**Cancel** CAN clears all data stored in the last print buffer and returns to the previous print position. LPRINT CHR$(&H18)
SP	**Space** SP moves the print position one character space to the right. LPRINT CHR$(&H20)

ESCAPE SEQUENCES

The following is an explanation of each IBM Proprinter command set escape sequence. A sample BASIC programming line is included for each sequence.

See Appendix A for a quick reference to these escape sequences.

ESC 0

8 lpi Line Spacing

ESC 0 sets the line spacing at 8 lpi.

```
LPRINT CHR$(&H1B);CHR$(&H30)
```

ESC 1

7/72–Inch Line Spacing

ESC 1 sets the line spacing at 7/72 inch.

```
LPRINT CHR$(&H1B);CHR$(&H31)
```

ESC 2

Begin Text Line Spacing

ESC 2 starts text line spacing, as specified by ESC A(n). If no ESC A(n) sequence has been entered, line spacing is 6 lpi.

```
LPRINT CHR$(&H1B);CHR$(&H32)
```

ESC 3(n)

n/216–Inch Line Spacing

ESC 3(n) sets line spacing at n/216 inch. The value of n ranges from 1 to 255. When the value of n is a multiple of 3, the paper moves exactly n/216 inch. Eight–bit graphics uses a 24/216–inch line spacing.

```
LPRINT CHR$(&H1B);CHR$(&H33);
CHR$(n)
```

ESC 4

Top of Form

ESC 4 sets the current paper position as the top of form. Any print data or line feed commands received prior to ESC 4 will be executed, and top-of-form will be set at the first line of the next page.

```
LPRINT CHR$(&H1B);CHR$(&H34)
```

ESC 5(n)

Automatic Line Feed

ESC 5(n) selects or cancels automatic line feeding. The printer performs a line feed each time it receives a carriage return (CR) code. ESC 5(n) overrides SW2-6.

n=1 selects automatic line feed.
n=0 cancels automatic line feed.

```
LPRINT CHR$(&H1B);CHR$(&H33);
CHR$(n)
```

ESC 6

Select Character Set 2

ESC 6 selects Character Set 2 (see Table 6-2).

```
LPRINT CHR$(&H1B);CHR$(&H36)
```

ESC 7

Select Character Set 1

ESC 7 selects Character Set 1 (see Table 6-1). Character Set 1 is the default character set.

```
LPRINT CHR$(&H1B);CHR$(&H37)
```

ESC A(n)	**Store Text Line Spacing** ESC A(n) stores a line spacing value of n/72 inch, where n ranges from 1 to 85. ESC 2 must be sent to start the text line spacing. LPRINT CHR$(&H1B);CHR$(&H33); CHR$(n)
ESC B (n1)(n2)(n...)NUL	**Set Vertical Tabs** This command sets vertical tab positions. Tabs must be set in ascending order, and up to 168 tabs can be set. The value n is the line on which the tab is set, with the line at the top of the form being line 1. The value of n ranges from 1 to 168. All tabs remain until new tabs are set. Once tabs are set, the control code VT is used to advance the paper to each tab setting. At power-on, no vertical tabs are set. When no tabs are set, the VT code performs a line feed. ESC B(n1)(n2)(n...)NUL is cancelled by ESC R or ESC B NUL. LPRINT CHR$(&H1B);CHR$(&H42); CHR$(n1);CHR$(n2);...CHR$(&H00)

ESC C(n)

Set Page Length (Lines)

ESC C(n) sets the page length at n lines per page. The value of n ranges from 1 to 255. If print data or a line feed command is received prior to ESC C(n), the top-of-form is set at the first line of the next page. The page length is not affected by a change in line spacing.

ESC C(n) cancels the automatic perforation skip (ESC N).

```
LPRINT CHR$(&H1B);CHR$(&H43);
CHR$(n)
```

ESC C NUL(n)

Set Page Length (Inches)

ESC C NUL(n) sets the page length at n inches per page. The value of n ranges from 1 to 22. If print data or a line feed command is received prior to ESC C NUL(n), the top-of-form is set at the first line of the next page.

ESC C NUL(n) cancels the automatic perforation skip (ESC N).

```
LPRINT CHR$(&H1B);CHR$(&H43);
CHR$(&H00);CHR$(n)
```

ESC D(n1)(n2)(n...)NUL

Set Horizontal Tabs

This command sets horizontal tab positions. Tabs must be set in ascending order, and up to 224 tabs can be set. The value n represents the column at which the tab is set.

All tabs remain until new ones are set.

At power–on, a tab is set at every eighth position, beginning at column 9. ESC D NUL cancels all previous tab settings, and ESC R resets tabs to power–on default values.

```
LPRINT CHR$(&H1B);CHR$(&H44);
CHR$(n1);CHR$(n2);...CHR$(&H00)
```

ESC E

Select Shadow Printing

ESC E selects the shadow printing mode. The printer prints a character once, then moves two dots to the right and prints the character again.

```
LPRINT CHR$(&H1B);CHR$(&H45)
```

ESC F

Cancel Shadow Printing

ESC F cancels the shadow printing mode.

```
LPRINT CHR$(&H1B);CHR$(&H46)
```

ESC G

Select Bold Printing

ESC G selects the bold printing mode. The print head prints a character once, then moves two dots above and prints the character again.

```
LPRINT CHR$(&H1B);CHR$(&H47)
```

ESC H

Cancel Bold Printing

ESC H cancels the bold printing mode.

LPRINT CHR$(&H1B);CHR$(&H48)

ESC I(n)

Select Font

ESC I(n) selects the standard or download font.

n=0, 2 selects the standard font.
n=4, 6 selects the download font.

To select the download font, use ESC = to first load the font.

LPRINT CHR$(&H1B);CHR$(&H49);
CHR$(n)

ESC J(n)

Advance Paper n/216 Inch

ESC J(n) advances the paper n/216 inch, where n ranges from 1 to 255. When the value of n is a multiple of 3, the paper moves exactly n/216 inch.

Table 6–4 lists the values of n for the most common line spacings and dot graphics.

Table 6–4 Common Values of n

SPACING	n/216
8 lpi	27/216
6 lpi	36/216
8–dot graphics	24/216
7–dot graphics	21/216

An automatic carriage return occurs when SW2–1 is on.

ESC J(n) is cleared after the line space takes place. The printer does not store the value of n.

When ESC J(n) is in effect, the printer ignores the automatic perforation skip sequence (ESC N).

LPRINT CHR$(&H1B);CHR$(&H4A);
CHR$(n)

ESC K(n1)(n2)(v1)(v2)(v...) **Select 480–Dot Graphics**

This sequence selects 480–dot graphics; that is, the printer can print up to 480 dot columns on an 8–inch line. Each column has up to eight dots. Spacing is 60 dots per inch horizontally and 72 dots per inch vertically.

The values n1 and n2 specify the total number of data bytes. The total number of data bytes is equal to n1 + (n2 x 256) and cannot exceed 480. For example, to print 480 dot columns, n1 = 224 and n2 = 1. The printer ignores any data bytes over 480.

The values v1 to v480 are the individual data bytes. v1 prints at the leftmost printing column, followed by v2, v3, etc. v480 prints at the rightmost column. All graphics printing occurs from left to right.

Each data byte is made up of a column of 8 bits, or dots. Each bit has an assigned value. Figure 6–1 shows a dot column with the decimal value of each dot position.

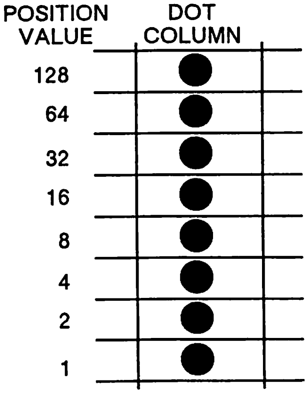


Figure 6–1 Dot Positions and Values

The value of a data byte is the sum of the values of the dots that you want to print. Figure 6–2 shows what the result would be if v1 = 69, v2 = 155, and v3 = 42.

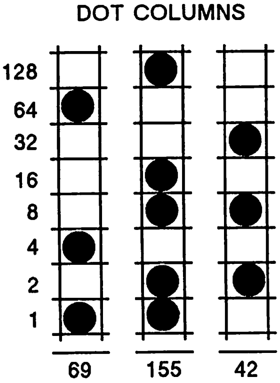


Figure 6–2 Data Byte Values

```
LPRINT CHR$(&H1B);CHR$(&H4B);
CHR$(n1);CHR$(n2);CHR$(v1);
CHR$(v2);...CHR$(v480)
```

ESC L(n1)(n2)(v1)(v2)(v...)	**Select 960-Dot Graphics (Half-speed)** This sequence prints up to 960 dot columns on an 8-inch line. The variables n1, n2, and v1 through v960 are the same as in 480-dot graphics. See ESC K for an explanation of these values. The total number of data bytes is equal to n1 + (n2 x 256) and cannot exceed 960. For example, to print 960 dot columns, n1 = 192 and n2 = 3. LPRINT CHR$(&H1B);CHR$(&H4C); CHR$(n1);CHR$(n2);CHR$(v1); CHR$(v2);...CHR$(v480)
ESC N(n)	**Select Automatic Perforation Skip** ESC N(n) selects the automatic perforation skip. The value n specifies the number of lines the printer skips at the end of each page, causing the printer to skip over the perforations between pages of continuous forms. The value of n ranges from 1 to 255. ESC N(n) is cancelled by ESC C(n) and ESC C NUL(n). LPRINT CHR$(&H1B);CHR$(&H4E); CHR$(n)
ESC O	**Cancel Automatic Perforation Skip** ESC O cancels the automatic perforation skip. LPRINT CHR$(&H1B);CHR$(&H4F)

ESC Q(3)

Deselect the Printer

ESC Q(3) tells the printer not to accept data from the computer, and is used for diagnostic purposes only. The control code DC1 must be sent to tell the printer to begin accepting data again.

```
LPRINT CHR$(&H1B);CHR$(&H51);
CHR$(&H33)
```

ESC R

Set All Tabs to Power–On Default Settings

ESC R sets all tabs to their default settings. Horizontal tabs are set at every eighth position beginning at column 9, and all vertical tabs are cleared.

```
LPRINT CHR$(&H1B);CHR$(&H52)
```

ESC S(n)

Select Subscripts or Superscripts

ESC S(n) selects subscripts or superscripts. ESC T cancels this sequence.

n=1 selects subscripts.
n=0 selects superscripts.

```
LPRINT CHR$(&H1B);CHR$(&H53);
CHR$(n)
```

ESC T

Cancel Subscripts or Superscripts

ESC T cancels subscripts or superscripts.

```
LPRINT CHR$(&H1B);CHR$(&H54)
```

ESC W(n)

Select or Cancel Elongated Printing

ESC W(n) selects or cancels elongated printing.

n=1 selects elongated printing.
n=0 cancels elongated printing.

```
LPRINT CHR$(&H1B);CHR$(&H57);
CHR$(n)
```

ESC Y(n1)(n2)(v1)(v2)(v...)

Select 960-Dot Graphics

This sequence prints up to 960 dot columns on an 8-inch line. (ESC Y functions the same way as ESC L.) Graphics data and text data can be used in the same line.

The variables n1, n2, and v1 through v960 are the same as in 480-dot graphics. See ESC K for an explanation of these values.

The total number of data bytes is equal to n1 + (n2 x 256) and cannot exceed 960. For example, to print 960 dot columns, n1 = 192 and n2 = 3.

```
LPRINT CHR$(&H1B);CHR$(&H59);
CHR$(n1);CHR$(n2);CHR$(v1);
CHR$(v2);...CHR$(v960)
```

ESC Z(n1)(n2)(v1)(v2)(v...)

Select 1920-Dot Graphics

This sequence prints up to 1920 dot columns on an 8-inch line. Graphics data and text data can be used in the same line.

The variables n1, n2, and v1 through v1920 are the same as in 480-dot graphics. See ESC K for an explanation of these values.

The total number of data bytes is equal to n1 + (n2 x 256) and cannot exceed 1920. For example, to print 1920 dot columns, n1 = 128 and n2 = 7.

```
LPRINT CHR$(&H1B);CHR$(&H5A);
CHR$(n1);CHR$(n2);CHR$(v1);
CHR$(v2);...CHR$(v1920)
```

ESC -(n)

Select and Cancel Continuous Underscore

ESC -(n) selects or cancels continuous underscore. When underscore is selected, the printer underlines all data and spaces that follow, with the exception of spaces resulting from an HT code.

n=1 selects continuous underscore.
n=0 cancels continuous underscore.

```
LPRINT CHR$(&H1B);CHR$(&H5F);
CHR$(n)
```

ESC :

Select 12 cpi Printing Mode

ESC : selects the 12 character per inch (cpi) printing mode. DC2 cancels this sequence and returns to 10 cpi mode.

```
LPRINT CHR$(&H1B);CHR$(&H3A)
```

ESC = (n1)(n2)DC4 (p)(s) NUL(+1)...(+11)

Download Characters

ESC = loads up to 94 characters into the download area of storage. If less than 94 are loaded, all characters must be in consecutive order. All downloaded characters remain in the download area until one of the following occurs:

- the printer's power is turned off,
- a character is overlayed by a new downloaded character,
- the programming line

```
LPRINT CHR$(&H1B);CHR$(&H3D);
CHR$(&H30);CHR$(&H30)
```

is sent to clear the download area.

The following explains each of the variables used with ESC =.

- The variables n1 and n2 indicate how many characters are to be downloaded. n1 and n2 are calculated as follows.

  total count = (number of characters x 13) + 2

  If the total count is less than 256, then n1 = total count and n2 = 0. For example, for 15 characters:

  total count = (15 x 13) + 2 = 197.
  n1 = 197 (C5 hexadecimal)
  n2 = 0

  If the total count is greater than or equal to 256, divide the number of bytes by 256. n1 = the remainder and n2 = the integer. For example, for 36 characters:

  total count = (36 x 13) + 2 = 468
  468/256 = 1 212/256
  n1 = 212 (D4 hexadecimal)
  n2 = 1

  When you send a programming line for ESC =, CHR$(&H14) must follow CHR$(n2). See the example at the end of the ESC = explanation.

- The variable p represents the ASCII decimal value for the first downloaded character. For example, to download a character set that replaces characters beginning with the uppercase letter "G", p would equal 71 (41 hexadecimal). You can download to any character from hexadecimal 21 to 7E. All characters must be consecutive from the starting point.

- The variable s indicates whether a character has an ascender or a descender (for example, a “d” versus a “g”). When s = 0, the character has an ascender, and when s = 1, the character has a descender.

  When you send a programming line for ESC =, CHR$(&H00) must follow CHR$(s). See the example at the end of the ESC = explanation.
- The variables t1 through t11 are the values of the dot columns.
- If plural characters are downloaded consecutively, repeat variables s through t11 for each character.

The following example replaces lowercase “e” (hexadecimal 65) with the copyright symbol (©).

Example:

total count = (1 x 13) + 2 = 15
n1 = 15 (0F hexadecimal)
n2 = 0
p = 101
s = 0

```
LPRINT CHR$(&H1B);CHR$(&H3D);
CHR$(&H0F);CHR$(&H00);CHR$(&H14);
CHR$(&H65);CHR$(&H00);CHR$(&H00);
CHR$(&H3C);CHR$(&H42);CHR$(&H00);
CHR$(&H99);CHR$(&HA5);
CHR$(&HA5);CHR$(&H81);CHR$(&H00);
CHR$(&H42);CHR$(&H3C)
```

ESC \(n1)(n2)

Select Continuous Printing From the All Characters Chart

This sequence allows the printing of all characters from the All Characters Chart (see Table 6–3). The printer normally recognizes the ASCII values with a decimal value below 32 as control codes. However, when this sequence is in effect, the printer prints the special symbols assigned to the ASCII control codes. No control code functions operate when this sequence is in effect.

This sequence may also be used to print the characters between decimal values 128 and 159. These characters make up Character Set 1. If a code value of an unassigned character is sent to the printer, a space will result.

The total number of characters equals n1 + (n2 x 256).

```
LPRINT CHR$(&H1B);CHR$(&H5C);
CHR$(n1);CHR$(n2)
```

ESC ^

Prints One Character From the All Characters Chart

ESC ^ prints one character from the All Characters Chart (see Table 6–3). This sequence allows you to print the special symbols found between decimal values 0 and 32 (normally recognized as control codes). No control code functions operate when this code is in effect.

```
LPRINT CHR$(&H1B);CHR$(&H5E)
```

ESC _(n)

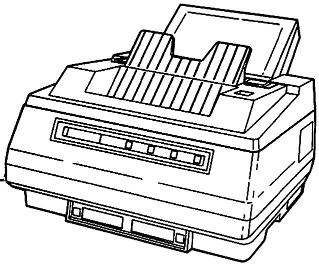
Select and Cancel Continuous Overscore

ESC _ selects or cancels continuous overscore. When overscore is selected, the printer overscores all data and spaces that follow, with the exception of spaces resulting from an HT code.

n=1 selects continuous overscore.
n=0 cancels continuous overscore.

```
LPRINT CHR$(&H1B);CHR$(&H2D);
CHR$(n)
```

Section 7



FS Sequences

This section supplies you with programming explanations and code descriptions for FS sequences. All FS sequences can be used with both the NEC XX50 command set and the 4201 IBM Proprinter command set.

This section is intended for users who write their own programs, and assumes some knowledge of BASIC programming. Users who do not write programs but depend on preprogrammed applications packages can skip this section completely, or read it for insight into how the printer works.

ASCII CODING

All FS sequences respond to the ASCII codes of the current command set. See Tables 5-1 and 5-2 for ASCII codes pertaining to the NEC XX50 command set, and Tables 6-1 through 6-3 for the ASCII codes applicable to the 4201 Proprinter command set.

Programming ASCII Characters

To print the ASCII character "A" from the table, use the ASCII A, its decimal equivalent, 65, or its hex equivalent, 41 (column 4, row 1). In BASIC you could use any of the following.

- LPRINT "A"
- LPRINT CHR$(65)
- LPRINT CHR$(&H41)

The preceding examples were for an uppercase "A". For a lowercase "a", the decimal equivalent is 97, not 65. The hex equivalent is 61, not 41. The following examples print a lowercase "a".

- LPRINT "a"
- LPRINT CHR$(97)
- LPRINT CHR$(&H61)

Programming Form Separator (FS) Sequences

Form separator (FS) sequences consist of the FS control code followed by one or more control characters. Note that the hexadecimal equivalent of the FS control code is &H1C.

For example, to program FS R, you could use any of the following.

• ASCII character form:	LPRINT CHR$(28);"R"
• Decimal form:	LPRINT CHR$(28);CHR$(82)
• Hex form:	LPRINT CHR$(&H1C);CHR$(&H52)

FS SEQUENCE EXPLANATIONS

Following are explanations of each FS sequence. The sample BASIC programming line provided for each sequence uses hexadecimal values.

See Appendix A for a quick reference to the FS sequences.

FS 0 <00>(α) **Select Download Character Set**

FS 0<00>(α) selects and activates printing of the downloaded character or character set. The value of <00> must remain <00>.

When α=a, download selection mode is set. When α=z, download selection mode is cancelled.

This mode neither activates the proportional spacing mode nor changes the HMI.

```
10 'DOWN LOAD CHARACTER SETTING
20 '
30 'Down Load registration mode ON
40 LPRINT CHR$(&H1C);CHR$(&H3B);CHR$(&H63);
50 '
60 'Down Load Character Set Starting
70 LPRINT CHR$(&H1C);CHR$(&H2F);CHR$(&H0);CHR$(&H0);
80 LPRINT CHR$(&H30);CHR$(&H30);
90 LPRINT CHR$(&H8);CHR$(&H18);CHR$(&H0);CHR$(&H18);CHR$(&H0);
                                         CHR$(&H48);CHR$(&H0);
100 FOR I = 1 TO 72
110    READ D$
120    LPRINT CHR$(VAL("&H"+D$));
130 NEXT I
140 '
150 'Down Load registration mode end
160 LPRINT CHR$(&H1C);CHR$(&H3B);CHR$(&H79)
170 '
180 'Down Load Character selection mode ON
190 LPRINT CHR$(&H1C);CHR$(&H30);CHR$(&H0);CHR$(&H61);
200 LPRINT CHR$(&H30)
210 '
220 'Down Load clear
230 LPRINT CHR$(&H1C);CHR$(&H3B);CHR$(&H7A)
235 '
240 END
250 '
260 DATA 00,3C,00,00,C3,00,03,00,C0,04,00,20
270 DATA 08,3C,10,10,C3,08,21,00,84,22,00,44
280 DATA 44,00,02,44,00,02,44,00,02,84,00,01
290 DATA 84,00,01,84,00,01,44,00,02,44,00,02
300 DATA 22,00,44,21,00,84,10,C3,08,08,3C,10
310 DATA 04,00,20,03,00,C0,00,C3,00,00,3C,00
```

FS 1<n11 n12>...

Line Drawing Mode

The following FS sequence is used to draw a line. An explanation of each variable follows.

FS 1<n11 n12><Xs1 Xs2><Xs3 Xs4><Ys1 Ys2><Ys3 Ys4><Xe1 Xe2><Xe3 Xe4><Ye1 Ye2><Ye3 Ye4>

<n11 n12>: type of line where
    n11 = 0:
    n11 = 1:
    n11 = 2:
    n11 = 3:

    n12 = 0: 2–dot width
    n12 = 1: 2–dot width
    n12 = 2: 2–dot width
    n12 = 3: 3–dot width
    n12 = 4: 4–dot width
    n12 = 6: 6–dot width

<Xs1 Xs2><Xs3 Xs4>:
the horizontal direction from the initial point to the starting point
Xs =256 x (Xs3 Xs4) + (Xs1 Xs2)

<Ys1 Ys2><Ys3 Ys4>:
the vertical distance from the initial point to the starting point
Ys =256 x (Ys3 Ys4) + (Ys1 Ys2)

<Xe1 Xe2><Xe3 Xe4>:
the horizontal distance from the initial point to the ending point
Xe =256 x (Xe3 Xe4) + (Xe1 Xe2)

<Ye1 Ye2><Ye3 Ye4>:
the vertical distance from the initial point to the ending point.
Ye =256 x (Ye3 Ye4) + (Ye1 Ye2)

Xs =Xe or Ys =Ye.

This command is acceptable in the form registration mode.

If the starting and ending positions are set beyond the print area, this command sets the positions within the print area.

If an oblique line is selected, this command is ignored.

```
LPRINT CHR$(&H1C);CHR$(&H31);
CHR$(n11 n12);CHR$(Xs1 Xs2);
CHR$(Xs3 Xs4);CHR$(Ys1 Ys2);
CHR$(Ys3 Ys4);CHR$(Xe1 Xe2);
CHR$(Xe3 Xe4);CHR$(Ye1 Ye2);
CHR$(Ye3 Ye4)
```

FS 2(α)

Form Registration Mode

FS 2(α) registers the form information in main memory. Only the line drawing mode command is accepted. Character codes are ignored. This mode is cancelled by any code other than the line drawing mode command.

When α=a, form registration mode starts.
When α=b, form registration mode ends.
When α=z, form registration mode is cancelled.

LPRINT CHR$(&H1C);CHR$(&H32);CHR$(α)

FS 4(α)

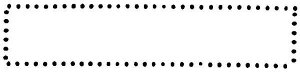
Form Information Reference

FS 4(α) picks up the form information from main memory.

When α=a, the form information reference is selected.
When α=z, the form information reference is cancelled.

This mode is cancelled when paper size is changed or when the font is switched between portrait and landscape.

```
10 'RULED LINE SETTING
20 '
30 'Form registration mode start
40 LPRINT CHR$(&H1C);CHR$(&H32);CHR$(&H61);
50 '
60 'Ruled Line Setting
70 LPRINT CHR$(&H1C);CHR$(&H31);CHR$(&H36);
80 LPRINT CHR$(&HA);CHR$(&H0);CHR$(&HA);CHR$(&H0);
90 LPRINT CHR$(&HFE);CHR$(&H1);CHR$(&HA);CHR$(&H0);
100 LPRINT CHR$(&H1C);CHR$(&H31);CHR$(&H36);
110 LPRINT CHR$(&HFE);CHR$(&H1);CHR$(&HA);CHR$(&H0);
120 LPRINT CHR$(&HFE);CHR$(&H1);CHR$(&H6E);CHR$(&H0);
130 LPRINT CHR$(&H1C);CHR$(&H31);CHR$(&H36);
140 LPRINT CHR$(&HFE);CHR$(&H1);CHR$(&H6E);CHR$(&H0);
150 LPRINT CHR$(&HA);CHR$(&H0);CHR$(&H6E);CHR$(&H0);
160 LPRINT CHR$(&H1C);CHR$(&H31);CHR$(&H36);
170 LPRINT CHR$(&HA);CHR$(&H0);CHR$(&H6E);CHR$(&H0);
180 LPRINT CHR$(&HA);CHR$(&H0);CHR$(&HA);CHR$(&H0);
190 '
200 'Form registration mode end
210 LPRINT CHR$(&H1C);CHR$(&H32);CHR$(&H62)
220 '
230 'Form information reference
240 LPRINT CHR$(&H1C);CHR$(&H34);CHR$(&H61)
250 LPRINT CHR$(&HC)
260 '
270 END
```



FS 5(α)(β)...

8-bit Dot Mode

The following FS sequence sets the 8-bit dot mode.

FS 5(α)(β)<1_{11} 1_{12}><m11 m12><n11 n12>
<d11 d12><d21 d22>...<dk1 dk2>

The values of α and β select the vertical and horizontal dot density as follows. The value of α must equal the value of β.

When α = a, vertical dot density is 1/75 in.
When α = b, vertical dot density is 1/150 in.
When α = c, vertical dot density is 1/300 in.

When β = a, horizontal dot density is 1/75 in.
When β = b, horizontal dot density is 1/150 in.
When β = c, horizontal dot density is 1/300 in.

The values <1_{11} 1_{12}>, <m11 m12>, and <n11 n12> represent the number of bytes to be transferred.

The following formula determines the actual data:

64,536 x (n11 n12) + 256 x (m11 m12) + (1_{11} 1_{12}).

This mode starts at the current print position and performs a carriage return at the right margin or rightmost print position. The 8-bit dot mode may be selected up to 8 times per page.

```
10 '8 BIT DOT MODE
20 '
30 LPRINT CHR$(&H1C);CHR$(&H35);CHR$(&H61);CHR$(&H61);
          CHR$(&H10);CHR$(&H0) ;CHR$(&H0) ;
40 '
50 FOR I = 1 TO 16
60   READ D$
70   LPRINT CHR$(VAL("&H"+D$));
80 NEXT I
90 '
100 'Set Right Margin at current position
110 LPRINT CHR$(&H1B);CHR$(&H4A);
120 '
130 LPRINT CHR$(&H1C);CHR$(&H35);CHR$(&H61);CHR$(&H61);
           CHR$(&H16);CHR$(&H0) ;CHR$(&H0) ;
140 '
150 LPRINT STRING$(6,&H0);
160 '
170 FOR J = 1 TO 16
180   READ D$
190   LPRINT CHR$(VAL("&H"+D$));
200 NEXT J
210 '
220 END
230 '
240 'Data of first frames
250 DATA 01,03,07,0F,1F,3F,7F,FF,FF,7F,3F,1F,0F,07,03,01,
260 'Data of second frames
270 DATA 80,C0,E0,F0,F8,FC,FE,FF,FF,FE,FC,F8,F0,E0,C0,80,
```

FS 6(α)(β)...

8-bit Dot Repeat

The following FS sequence sets the 8-bit dot repeat mode.

FS 6(α)(β)<1_{11} 1_{12}><m11 m12><n11 n12>
<d11 d12>

The values of α and β select the vertical and horizontal dot density as follows. The value of α must equal the value of β.

When α = a, vertical dot density is 1/75 in.
When α = b, vertical dot density is 1/150 in.
When α = c, vertical dot density is 1/300 in.

When β = a, horizontal dot density is 1/75 in.
When β = b, horizontal dot density is 1/150 in.
When β = c, horizontal dot density is 1/300 in.

The following formula determines the number of times data is to be repeated.

64536 x (n11 n12) + 256 x (m11 m12 + 1_{11} 1_{12})

The value (d11 d12) represents the data to be printed.

```
10 '8 Bit Dot Repeat
20 '
30 LPRINT CHR$(&H1C);CHR$(&H36);CHR$(&H61);CHR$(&H61);
          CHR$(&HFF);CHR$(&H0) ;CHR$(&H0) ;
40 LPRINT CHR$(&H55)
50 '
60 END
```

FS 7(α)(β)...

16–bit Dot Mode

The following FS sequence sets the 16–bit dot mode.

FS 7(α)(β)<1_{11} 1_{12}><m11 m12><n11 n12>
<d11 d12><d13 d14>...

The values of α and β select the vertical and horizontal dot density as follows. The value of α must equal the value of β.

When α = a, vertical dot density is 1/75 in.
When α = b, vertical dot density is 1/150 in.
When α = c, vertical dot density is 1/300 in.

When β = a, horizontal dot density is 1/75 in.
When β = b, horizontal dot density is 1/150 in.
When β = c, horizontal dot density is 1/300 in.

The values <1_{11} 1_{12}>, <m11 m12>, and <n11 n12> represent the number of bytes to be transferred.

The following formula determines the actual data:

64536 x (n11 n12) + 256 x (m11 m12) + (1_{11} 1_{12}).

This mode starts at the current print position and performs a carriage return at the right margin or rightmost print position. The 16–bit dot mode may be selected up to 8 times per page.

```
10 '16 BIT DOT MODE
20 '
30 LPRINT CHR$(&H1C);CHR$(&H37);CHR$(&H61);CHR$(&H61);
          CHR$(&H4D);CHR$(&H0) ;CHR$(&H0);
40 '
50 FOR I = 1 TO 154
60   READ D$
70   LPRINT CHR$(VAL("&H"+D$));
80 NEXT I
90 '
100 LPRINT CHR$(&H1B);CHR$(&H4A);'set right margin
110 '
120 LPRINT CHR$(&H1C);CHR$(&H37);CHR$(&H61);CHR$(&H61);
           CHR$(&H54);CHR$(&H0) ;CHR$(&H0);
130 '
140 LPRINT STRING$(14,&H0);
150 '
160 FOR J = 1 TO 154
170    READ D$
180    LPRINT CHR$(VAL("&H"+D$));
190 NEXT J
200 '
210 END
220 '
230 'Data of first frame
240 DATA 00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00
250 DATA 00,00,00,00,00,00,00,00,00,00,00,00,00,01,00,03,00,05,00,0B
260 DATA 00,13,00,27,00,47,00,8F,01,1F,02,0F,04,0F,08,07,10,07,20,03
270 DATA 40,03,80,01,80,01,80,01,80,03,80,03,80,07,80,07,80,0F,80,0F
280 DATA 80,07,80,07,80,03,80,03,80,01,80,01,40,01,20,03,10,03,08,07
290 DATA 04,07,02,0F,01,0F,00,9F,00,4F,00,27,00,13,00,0B,00,05,00,03
300 DATA 00,01,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00
310 DATA 00,00,00,00,00,00,00,00,00,00,00,00,00,00
320 '
330 'Data of second frame
340 DATA 00,01,00,03,00,07,00,0F,00,1F,00,3F,00,7F,00,FF,01,FF,03,FF
350 DATA 07,FF,0F,FF,1F,FF,3F,FF,7F,FF,FF,FF,FF,FF,FF,FF,FF,FF,80,03
360 DATA EF,FF,F7,FF,FB,FF,FD,FF,FE,FF,FF,7F,FF,BF,FF,DF,FF,EF,80,03
370 DATA FF,FF,FF,FF,FF,FF,80,03,BE,FB,BE,FB,BE,FB,BE,FB,BE,FB,BE,FB
380 DATA BE,FB,BF,FB,BF,FB,FF,FF,FF,FF,FF,FF,E0,1F,DF,EF,BF,F7,BF,FB
390 DATA BF,FB,BF,FB,BF,FB,BF,FB,BF,FB,DF,F7,EF,EF,FF,FF,FF,FF,FF,FF
400 DATA FF,FF,FF,FF,7F,FF,3F,FF,1F,FF,0F,FF,07,FF,03,FF,01,FF,00,FF
410 DATA 00,7F,00,3F,00,1F,00,0F,00,07,00,03,00,01
```

FS 8(α)(β)...

16-bit Dot Repeat

The following FS sequence sets the 16-bit dot repeat mode.

FS 8(α)(β)<1_{11} 1_{12}><m11 m12><n11 n12> <d11 d12><d13 d14>...

The values of α and β select the vertical and horizontal dot density as follows. The value of α must equal the value of β.

When α = a, vertical dot density is 1/75 in.
When α = b, vertical dot density is 1/150 in.
When α = c, vertical dot density is 1/300 in.

When β = a, horizontal dot density is 1/75 in.
When β = b, horizontal dot density is 1/150 in.
When β = c, horizontal dot density is 1/300 in.

The following formula determines the number of times data is to be repeated.

64536 x (n11 n12) + 256 x (m11 m12) + 1_{11} 1_{12}

The value (d11 d12) represents the data to be printed.

```
10 '16 Bit Dot Repeat
20 '
30 LPRINT CHR$(&H1C);CHR$(&H38);CHR$(&H61);CHR$(&H61);
          CHR$(&HFF);CHR$(&H0)  ;CHR$(&H0);
40 LPRINT CHR$(&H55);CHR$(&H55)
50 '
60 END
```

FS 9(α)(β)

Raster Graphics Starting Point

FS 9(α)(β) defines the starting point of raster graphics.

The starting point is designated by (Xs, Ys) where Xs = 256 x (Xs3 Xs4) + Xs1 Xs2 , and Ys = 256 x (Ys3 Ys4) + Ys1 Ys2.

The default value of the starting point is (0,0). If the starting point is set beyond the bottom margin, the command is ignored.

When α=a, raster graphics move in a horizontal (X) direction from the initial point. When β=a, raster graphics move in a vertical (Y) direction from the initial point (see Figure 7–1).

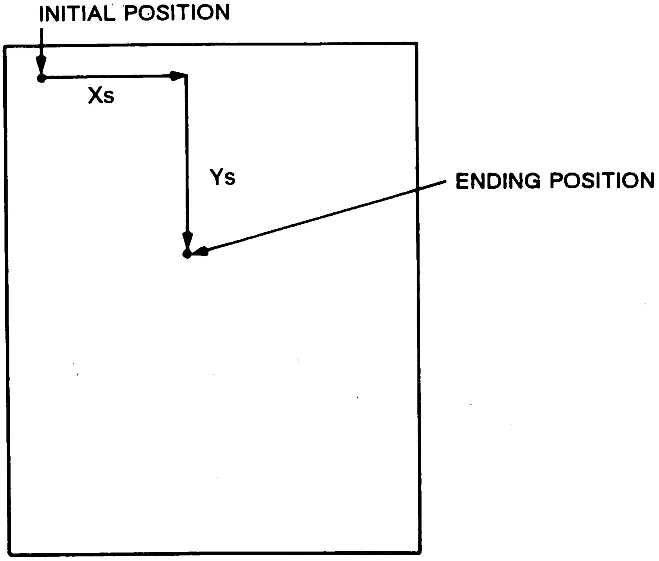


Figure 7–1 Raster Graphics

FS C(α) **Command Set**

FS C(α) selects the command set. The power–on default is the NEC XX50 command set.

When α=a, the 4201 IBM Proprinter command set is selected.

When α=z, the NEC XX50 command set is selected.

```
LPRINT CHR$(&H1C);CHR$(&H43);CHR$(α)
```

FS E(n) **VMI Spacing**

FS E(n) sets the vertical motion index at a value between 0 and 255/300 in.

FS F(n) **HMI Spacing**

FS F(n) sets the horizontal motion index at a value between 0 and 255/300 in.

FS H(α) **Paper–Size Error**

FS H(α) selects or cancels the paper–size error alarm.

When α=a, the paper–size error alarm is deactivated.

When α=b, the paper–size error alarm is activated.

FS R(α)

International Character Sets

FS R(α) selects the international character sets as follows.

α = a: USA
α = b: France
α = c: Germany
α = d: U.K.
α = e: Denmark
α = f: Sweden
α = g: Italy
α = h: Spain
α = i: Japan
α = j: Norway
α = k: Denmark II
α = l: Netherlands

FS !(α)

Auto Superscript or Subscript

FS !(α) selects automatic superscript or subscript. The printer performs a 1/2 forward or reverse line feed.

When α=a, subscript is selected.
When α=b, superscript is selected.
When α=z, the superscript/subscript mode is cancelled.

If the FS !(α) command is received more than once on the same line, only one line feed is performed.

If the superscript command is received on the top line of the page, the print position is lowered. If the subscript command is received on the bottom line of the page, a form feed is performed and printing continues on the next page.

FS "(α)<$\beta_1\beta_2$>

Top Margin

FS "(α)<$\beta_1\beta_2$> designates the top margin position and then moves the paper to this position.

When α=a, the designation is made in HMI. When α=b, the designation is made in inches.

The value $\beta_1\beta_2$ is the number of lines in the top margin.

The range of $\beta_1\beta_2$ is 00 to FF (hex), and must be less than the paper length. Any value greater than the paper length is ignored.

If the value of $\beta_1\beta_2$ is less than 50 dots above the bottom margin, the setting is invalid and the paper moves to the previously set top margin.

```
10 'Setting The Top Margin
20 '
30 LPRINT CHR$(&H1C);CHR$(&H22);CHR$(&H61);CHR$(&H5)
40 LPRINT "Set Top Margin at 5th line !"
50 '
60 END
```

```




Set Top Margin at 5th line !
```

FS #(α)<$\beta_1\beta 2$>

Text Length

FS #(α)<$\beta_1\beta 2$> sets the number of lines of text in a page.

When α=a, the designation is made in HMI. When α=b, the designation is made in inches.

The value $\beta_1\beta_2$ is the number of lines of text.

The range of $\beta_1\beta_2$ is 00 to FF (hex), and must be less than the paper length. If the value is greater than the paper length, or if the value is equal to 00, the bottom margin is set on the bottom line of the paper.

If the value of $\beta_1\beta_2$ is less than the present print line, a form feed is performed and the current bottom margin setting remains in effect.

```
10 'Setting Text Length
20 '
30 LPRINT CHR$(&H1C);CHR$(&H23);CHR$(&H61);CHR$(&H2);
40 '
50 FOR I = 1 TO 4
60    LPRINT "setting TEXT LENGTH ";I
70 NEXT I
80 '
90 LPRINT CHR$(&H1C);CHR$(&H24);
100 LPRINT "It is cleared now."
110 '
120 END
```

```
setting TEXT LENGTH  1
setting TEXT LENGTH  2

   setting TEXT LENGTH  3
   setting TEXT LENGTH  4
   It is cleared now.
```

FS $

Top Margin and Text Length Cleared

FS $ clears the top margin and text length settings.

`LPRINT CHR$(&H1C);CHR$(&H24)`

FS %(α)

Skip Perforation Mode

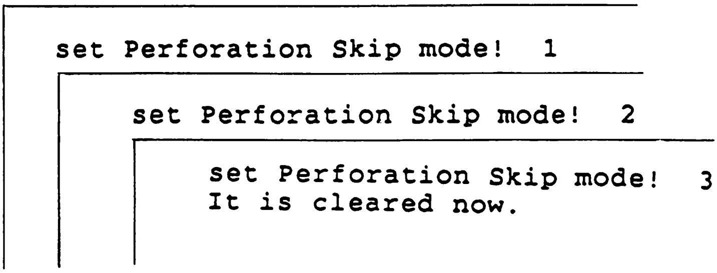
FS %(α) sets and cancels the perforation skip mode.

When α=a, the perforation skip mode is set and the printer skips from the last line of text to the top margin of the following page.

When α=z, this mode is cancelled and the printer prints to the last line of the page.

The perforation skip mode defaults to on at power–on.

```
10 'Perforation Skip Mode
20 '
30 'set text length
40 LPRINT CHR$(&H1C);CHR$(&H23);CHR$(&H61);CHR$(&H1);
50 'set perforation skip mode
60 LPRINT CHR$(&H1C);CHR$(&H25);CHR$(&H61);
70 '
80 FOR I = 1 TO 3
90    LPRINT "set Perforation Skip mode! ';I
100 NEXT I
110 '
120 'clear perforation skip mode
130 LPRINT CHR$(&H1C);CHR$(&H25);CHR$(&H5A);
140 'clear text length
150 LPRINT CHR$(&H1C);CHR$(&H24);
160 LPRINT "It is cleared now."
170 '
180 END
```



```
set Perforation Skip mode!  1

    set Perforation Skip mode!  2

        set Perforation Skip mode!  3
        It is cleared now.
```

FS &(α)
<m11m12><n11n12>

Horizontal Cursor Position

FS &(α)<m11 m12><n11 n12> positions the cursor horizontally.

When α=a, the cursor moves to the right from the initial print position.

When α=b, the cursor moves to the left from the initial print position.

When α=c, the cursor moves to the right from the current print position.

When α=d, the cursor moves to the left from the current print position.

The distance formula is

$$(256 \times n11\ n12) + m11\ m12$$

where the range of m11 m12 and n11 n12 is 00 to FF (hex). The distance value = 1/300 in.

```
10 'HORIZONTAL CURSOR POSITIONING
20 '
30 LPRINT "*=I";
40 '
50 LPRINT CHR$(&H1C);CHR$(&H26);CHR$(&H61);CHR$(&H2C);CHR$(&H1);
60 LPRINT "*=A";
70 LPRINT CHR$(&H1C);CHR$(&H26);CHR$(&H63);CHR$(&H2C);CHR$(&H1);
80 LPRINT "*=C";
90 LPRINT CHR$(&H1C);CHR$(&H26);CHR$(&H64);CHR$(&H2C);CHR$(&H1);
100 LPRINT "*=D";
110 '
120 END
```

```
*=I       *=A   *=D    *=C
```

FS '(α) <m11m12><n11n12>

Vertical Cursor Position

FS '(α)<m11 m12><n11 n12> positions the cursor vertically.

When α=a, the cursor moves downward from the initial print position.

When α=b, the cursor moves upward from the initial print position.

When α=c, the cursor moves downward from the current print position.

When α=d, the cursor moves upward from the current print position.

The distance formula is

$$(256 \times n11\ n12) + m11\ m12$$

where the range of m11 m12 and n11 n12 is 00 to FF (hex). The distance value = 1/300 in.

```
10 'VERTICAL CURSOR POSITIONING
20 '         --
30 LPRINT CHR$(&H1B);CHR$(&H45);'auto underscore ON
40 '
50 LPRINT "* ---> I"
60 '
70 LPRINT CHR$(&H1C);CHR$(&H27);CHR$(&H61);CHR$(&H32);CHR$(&H0);
80 LPRINT "A ---> *";
90 LPRINT CHR$(&H1C);CHR$(&H27);CHR$(&H63);CHR$(&H2C);CHR$(&H1);
100 LPRINT "C ---> *";
110 LPRINT CHR$(&H1C);CHR$(&H27);CHR$(&H64);CHR$(&H64);CHR$(&H0);
120 LPRINT "D ---> *"
130 '
140 LPRINT CHR$(&H1B);CHR$(&H52);'auto underscore OFF
150 '
160 END
```

```
* ---> I
A ---> *



              D ---> *

       C ---> *
```

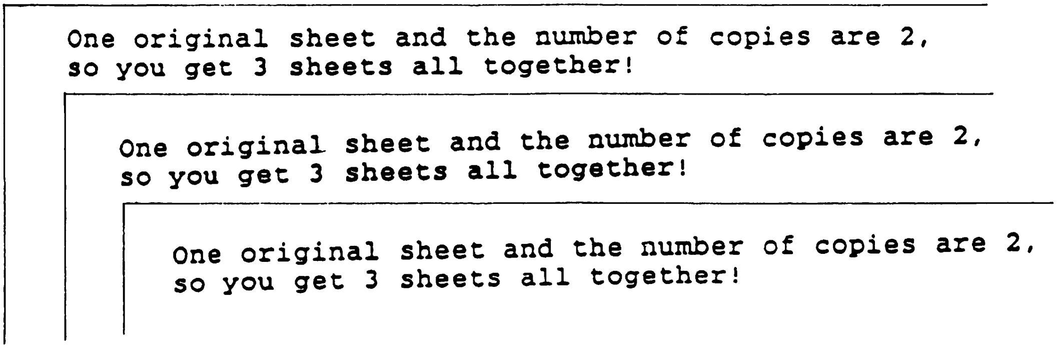
FS (<n1 n2>

Number of Copies

FS (<n1 n2> selects the number of copies. The value of n1 n2 designates the number of copies and ranges from 00 to FF (hex).

When the value of n1 n2 is 00, the number of copies is zero, and one original sheet is printed. When the value of n1 n2 is 01, the number of copies is one, and one original and one copy are printed.

```
10 'Select Number of Copies
20 '
30 'The number of copies are 2
40 LPRINT CHR$(&H1C);CHR$(&H28);CHR$(&H2);
50 '
60 LPRINT "One original sheet and the number of copies are 2,"
70 LPRINT "so you get 3 sheets all together!"
80 '
90 END
```



```
One original sheet and the number of copies are 2,
so you get 3 sheets all together!
```

```
One original sheet and the number of copies are 2,
so you get 3 sheets all together!
```

```
One original sheet and the number of copies are 2,
so you get 3 sheets all together!
```

**FS)
<m11m12><n11n12>**

Font Select

FS)<m1 m2><n1 n2> selects the font. The value of m1 m2 is the code number of the font and ranges from 00 to FF (hex). The value of n1 n2 is fixed at 00. The HMI value is not affected by this command.

After this code has been received, it is possible to switch between portrait and landscape from the present page if no print data remains in the buffer and the print position is at the leftmost position of top of form. Otherwise, switching is possible from the following page.

If the values of m1 m2 and n1 n2 do not correspond to an existing font, the following occurs:

- When switching from portrait to portrait or landscape to landscape, the command is ignored.
- When switching from portrait to landscape and the corresponding portrait font does not exist, Courier 10 portrait is set.
- When switching from portrait to landscape and the corresponding landscape font does not exist, Courier 12 landscape is set.

```
10 'FONT SELECTION
20 '
30 LPRINT "This font is contained in resident."
40 LPRINT
50 '
60 LPRINT CHR$(&H1C);CHR$(&H29);CHR$(&HC);CHR$(&H0);
70 LPRINT "To select this font,"
80 LPRINT "it is contained in the font cartridge."
90 LPRINT
100 '
110 'Enable Proportional Space Printing
120 LPRINT CHR$(&H1B);CHR$(&H52);
130 LPRINT "Proportional Space Printing ON"
140 LPRINT
150 '
160 'Disable Proportional Space Printing
170 LPRINT CHR$(&H1B);CHR$(&H54);
180 LPRINT "Proportional Space Printing OFF"
190 '
200 END
```

```
This font is contained in resident.

To select this font,
it is contained in the font cartridge.

Proportional Space Printing ON

Proportional Space Printing OFF
```

FS *(α)

Manual Feed Mode

FS *(α) selects the manual feed mode from the host CPU.

When α=a, manual feed is set.
When α=b, the first hopper is selected.
When α=c, the second hopper is selected.
When α=z, the printer returns to the previously selected mode.

The manual feed mode can be selected from the present page if no print data remains in the buffer and the print position is at the leftmost position of top of form. Otherwise, manual feed is selected from the following page.

Manual feed can also be selected from the control panel.

```
LPRINT CHR$(&H1C);CHR$(&H2A);
CHR$(α)
```

FS +(α)

Magnification Mode

FS +(α) selects the magnification mode.

When α=a, lateral magnification is set.
When α=b, longitudinal magnification is set.
When α=c, angular magnification is set.
When α=z, magnification mode is cancelled.

```
10 'MAGNIFICATION SETTING
20 '
30 LPRINT "MAGNIFICATION"
40 LPRINT
50 '
60 LPRINT CHR$(&H1C);CHR$(&H2B);CHR$(&H61);
70 LPRINT "LATERAL"
80 LPRINT
90 '
100 LPRINT CHR$(&H1C);CHR$(&H2B);CHR$(&H62);
110 LPRINT "LONGITUDINAL"
120 LPRINT
130 '
140 LPRINT CHR$(&H1C);CHR$(&H2B);CHR$(&H63);
150 LPRINT "ANGULAR"
160 LPRINT
170 '
180 LPRINT CHR$(&H1C);CHR$(&H2B);CHR$(&H7A);
190 LPRINT "CANCEL MAGNIFICATION"
200 END
```

```
MAGNIFICATION

LATERAL

LONGITUDINAL

ANGULAR

CANCEL MAGNIFICATION
```

FS ,(α)

Screen (Dot Mesh) Printing

FS ,(α) selects screen (dot mesh) printing.

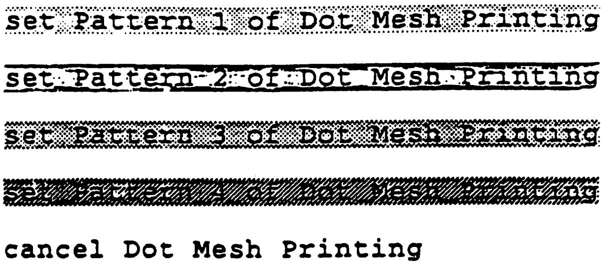
When α=a, pattern 1 is selected.
When α=b, pattern 2 is selected.
When α=c, pattern 3 is selected.
When α=d, pattern 4 is selected.
When α=z, the printing mode is cancelled.

When switching from one pattern to another, it is necessary to first cancel the present pattern and then select the new pattern.

The character height is specified by the tallest character in one line.

This mode is invalid with right–to–left printing.

```
10 'DOT MESH PRINTING
20 '
30 LPRINT CHR$(&H1C);CHR$(&H2C);CHR$(&H41);
40 LPRINT "set Pattern 1 of Dot Mesh Printing"
50 LPRINT CHR$(&H1C);CHR$(&H2C);CHR$(&H5A)
60 '
70 LPRINT CHR$(&H1C);CHR$(&H2C);CHR$(&H42);
80 LPRINT "set Pattern 2 of Dot Mesh Printing"
90 LPRINT CHR$(&H1C);CHR$(&H2C);CHR$(&H5A)
100 '
110 LPRINT CHR$(&H1C);CHR$(&H2C);CHR$(&H43);
120 LPRINT "set Pattern 3 of Dot Mesh Printing"
130 LPRINT CHR$(&H1C);CHR$(&H2C);CHR$(&H5A)
140 '
150 LPRINT CHR$(&H1C);CHR$(&H2C);CHR$(&H44);
160 LPRINT "set Pattern 4 of Dot Mesh Printing"
170 LPRINT CHR$(&H1C);CHR$(&H2C);CHR$(&H5A)
180 '
190 LPRINT "cancel Dot Mesh Printing"
200 '
210 END
```



```
set Pattern 1 of Dot Mesh Printing

set Pattern 2 of Dot Mesh Printing

set Pattern 3 of Dot Mesh Printing

set Pattern 4 of Dot Mesh Printing

cancel Dot Mesh Printing
```

FS -(α)

Reverse (White on Black) Printing

FS -(α) selects reverse (white on black) printing.

When α=a, reverse printing mode is selected. When α=z, reverse printing mode is cancelled.

The character height is specified by the tallest character on one line.

This mode is invalid with dot mesh printing.

```
10 'REVERSE PRINTING
20 '
30 LPRINT CHR$(&H1C);CHR$(&H2D);CHR$(&H41);
40 LPRINT "set Reverse Printing"
50 '
60 LPRINT CHR$(&H1C);CHR$(&H2D);CHR$(&H5A);
70 LPRINT "back to the normal printing again!"
80 '
90 END
```

```
set Reverse Printing
back to the normal printing again!
```

FS .(α)

Printer Test Mode

FS .(α) selects the printer test mode. When the printer receives this code, it completes the current page and then stops printing. A check of the unused portion of memory and a firmware checksum test are performed. Any faults are displayed on the control panel. If no faults are found, printing is resumed.

When α=a, the printer test mode is selected. When α=z, the printer test mode is cancelled.

LPRINT CHR$(&H1C);CHR$(&H2E);
CHR$($\alpha$)

FS ;(α)

Download Registration Mode

This command defines the memory size of the download area and should be sent between pages.

When α=a, download memory size is 8 bytes.
When α=b, download memory size is 16 bytes.
When α=c, download memory size is 32 bytes.
When α=d, download memory size is 64 bytes.
When α=y, download registration mode ends.
When α=z, download is cancelled.

This command must be sent before sending the FS / code.

```
LPRINT CHR$(&H1C);CHR$(&H3B);
CHR$(α)
```

FS /<00><0t>...

Define Download Character Set

The following FS sequence is used to define the download character set. An explanation of each variable follows.

FS /<00><m11 m12><n11 n12><$1_{01}1_{02}$>
<h01 h02><a01 a02><a03 a04><a05 a06>
<b01 b02><b03 b04><P01 P02>...<PeK PeL>

<00>: always 00

<0t>: t=0 portrait
t=1 landscape

<m11 m12><n11 n12>: the characters to be converted to download characters. <m11 m12> signifies the first character and <n11 n12> signifies the last character.

<$1_{01}1_{02}$>: length from the bottom to the baseline

<h01 h02>: maximum height of download characters

<a01 a02>: space to the left of the character

<a03 a04>: space making up the character

<a05 a06>: space to the right of the character

<b01 b02><b03 b04>: number of bytes sent from host CPU

256 x <b01 b02>+<b03 b04>

<P01 P02>...<PeK PeL>: data

The download registration code, FS ;(α), must be sent prior to this code.

LPRINTCHR$(&H1C);CHR$(&H2F);
CHR$(00);CHR$(0t);CHR$(m11 m12);...
CHR$(PeK PeL)

Figure 7–2 shows the variables that define a download character.

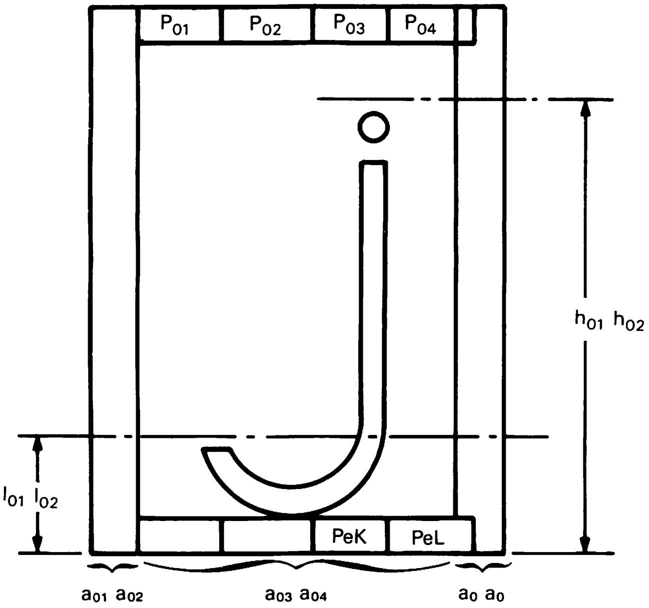


Figure 7–2 Download Character

FS :(α)(β)

Raster Graphics Transfer

The following sequence starts the raster graphics transfer.

FS :(α)(β)<m11 m12><m13 m14><n11 n12>
<n13 n14>

The values of α and β select the vertical and horizontal dot density respectively, as follows. The value of α must equal the value of β.

When α = a, the horizontal dot density is 1/75 in.
When α = b, the horizontal dot density is 1/150 in.
When α = c, the horizontal dot density is 1/300 in.

When β = a, the vertical dot density is 1/75 in.
When β = b, the vertical dot density is 1/150 in.
When β = c, the vertical dot density is 1/300 in.

The following formulas show how to calculate the values of xd and yd, as shown in Figure 7–3.

xd = 256 x (m13 m14) + m11 m12
yd = 245 x (n13 n14) + n11 n12

Any data beyond the print area is ignored.

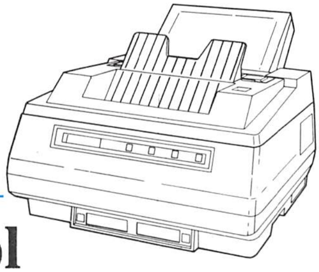
If the error "Data Overflow" occurs and the graphics board is not installed, data will be printed on the following page.

The dot density value α is used in angular magnification – see FS +(α). If the value of α is other than a, b, or c, dot density is 1/300 in.

```
LPRINT CHR$(&H1C);CHR$(&H3A);
CHR$(m11 m12);...CHR$(n13 n14)
```

```
10 'Raster Graphics Start Positioning
20 LPRINT CHR$(&H1C);CHR$(&H39);CHR$(&H61);CHR$(&H61);
30 LPRINT CHR$(&H64);CHR$(&H0);CHR$(&HC8);CHR$(&H0);
40 '
50 'Raster Graphics Transfer Starting
60 LPRINT CHR$(&H1C);CHR$(&H3A);CHR$(&H61);CHR$(&H61);
70 LPRINT CHR$(&H20);CHR$(&H0);CHR$(&H18);CHR$(&H0);
80 '
90 FOR I = 1 TO 96
100    READ D$
110    LPRINT CHR$(VAL("&H"+D$));
120 NEXT I
130 '
140 DATA 03,80,01,C0,04,40,02,20,08,20,04,10,10,10,08,08,20,08,10,04
150 DATA 40,04,20,02,80,02,40,01,80,01,80,01,88,30,0C,31,88,48,12,49
160 DATA 88,41,92,31,88,48,12,49,4E,30,0C,32,20,00,00,04,10,00,00,08
170 DATA 08,00,00,10,04,00,00,20,02,00,00,40,01,00,00,80,00,80,01,00
180 DATA 00,60,06,00,00,18,18,00,00,06,60,00,00,01,80,00
190 '
200 END
```

Appendix A



Quick Reference to Control Codes and Sequences

The following tables provide a quick reference to

- NEC XX50 command set codes and escape sequences.
- 4201 IBM Proprinter command set codes and escape sequences.
- all form separator (FS) sequences.

Table A–1 is a quick reference to the NEC XX50 command set control codes and escape sequences, their hex and decimal equivalents, and their functions. See Section 5 for an explanation of each code and sequence.

Table A–1 NEC XX50 Command Set Control Codes and Escape Sequences

CONTROL CODE OR ESC SEQUENCE	CONTROL CHARACTER EQUIVALENTS HEX	DECIMAL	FUNCTION
NUL	00	00	Terminates tab selection sequences.
STX	02	02	Command of Shift Out. Reset by ETX code.
ETX	03	03	Command of Shift In. Reset by STX code. SW3–3 can cancel this function.
BEL	07	07	Sounds the buzzer.
BS	08	08	Moves the print position one space to the left.

Table A–1 NEC XX50 Command Set Control Codes and Escape Sequences (cont'd)

CONTROL CODE OR ESC SEQUENCE	CONTROL CHARACTER EQUIVALENTS HEX	DECIMAL	FUNCTION
HT	09	09	Moves the print position to the next preset horizontal tab.
LF	0A	10	Advances the paper one line.
VT	0B	11	Moves the print position to the next preset vertical tab.
FF	0C	12	Advances to the next top of form.
CR	0D	13	Returns the print position to the left margin.
SO	0E	14	Sets double spacing.
SI	0F	15	Sets the HMI to 17 cpi. When no pitch is selected, this function is ignored.
DC1	11	17	Activates the printer.
DC2	12	18	Cancels SI (17 cpi) and returns the printer to the previously set print mode.
DC3	13	19	Causes the printer to pause.
DC4	14	20	Cancels double spacing.
CAN	18	24	Cancels the current line of data.
SP	20	32	Moves the print position one space to the right. With proportional spacing (PS) mode, activates horizontal motion index (HMI).

Table A-1 NEC XX50 Command Set Control Codes and Escape Sequences (cont'd)

CONTROL CODE OR ESC SEQUENCE	CONTROL CHARACTER EQUIVALENTS		FUNCTION
	HEX	DECIMAL	
DEL	7F	127	Same as CAN.
ESC 0	1B 30	27 48	Sets line spacing at 8 lpi.
ESC 1	1B 31	27 49	Sets line spacing at 10 lpi.
ESC 2	1B 32	27 50	Sets line spacing at 6 lpi.
ESC 3	1B 33	27 51	Not used.
ESC 4	1B 34	27 52	Not used.
ESC 5	1B 35	27 53	Selects RAM table.
ESC 6	1B 36	27 54	Not used.
ESC 7	1B 37	27 55	Performs reverse line feed.
ESC 8	1B 38	27 56	Not used.
ESC 9	1B 39	27 57	Not used.
ESC A(n)	1B 41(n)	27 65(n)	Sets VMI line feed.
ESC B(n1) (n2) ... (nk)NUL	1B 42(n1) (n2)..(nk) NUL	27 66(n1) (n2)...(nk) NUL	Sets vertical tabs.
ESC C(n)	1B 43(n)	27 67(n)	Sets lines per page.
ESC D (n1) (n2) ... (nk)NUL	1B 44 2B (n1) (n2)... (nk)NUL	27 6 8 43 (n1)(n2)... (nk)NUL	Sets horizontal tabs.
ESC E	1B 45	27 69	Starts automatic bold printing.
ESC F	1B 46	27 70	Cancels automatic bold printing.

Table A-1 NEC XX50 Command Set Control Codes and Escape Sequences (cont'd)

CONTROL CODE OR ESC SEQUENCE	CONTROL CHARACTER EQUIVALENTS HEX	DECIMAL	FUNCTION
ESC G	1B 47	27 71	Sets automatic shadow printing.
ESC H	1B 48	27 72	Cancels automatic shadow printing.
ESC I	1B 49	27 73	Sets character spacing at 12 cpi.
ESC J	1B 4A	27 74	Sets right margin.
ESC K	1B 4B	27 75	Clears right margin.
ESC L	1B 4C	27 76	Cancels program mode.
ESC M	1B 4D	27 77	Sets left margin.
ESC N	1B 4E	27 78	Not used.
ESC O	1B 4F	27 79	Clears left margin.
ESC P	1B 50	27 80	Sets program mode.
ESC Q	1B 51	27 81	Performs a fine back space.
ESC R	1B 52	27 82	Sets automatic proportional spacing.
ESC S	1B 53	27 83	Sets character spacing at 10 cpi.
ESC T	1B 54	27 84	Cancels automatic proportional spacing.
ESC U(n)	1B 55(n)	27 85(n)	Sets left margin at the (n)th column.
ESC V(n)	1B 56(n)	27 86(n)	Not used.

Table A–1 NEC XX50 Command Set Control Codes and Escape Sequences (cont'd)

CONTROL CODE OR ESC SEQUENCE	CONTROL CHARACTER EQUIVALENTS HEX	DECIMAL	FUNCTION
ESC W(n)	1B 57(n)	27 87(n)	Sets right margin at the (n)th column.
ESC X	1B 58	27 88	Not used.
ESC Y	1B 59	27 89	Cancels right–to–left printing.
ESC Z	1B 5A	27 90	Sets right–to–left printing.
ESC SO	1B 0E	27 14	Sets double–space printing.
ESC SI	1B 0F	27 15	Sets character spacing at 17 pitch in pitch select mode.
ESC &	1B 26	27 38	Cancels word processing mode.
ESC '	1B 27	27 39	Cancels automatic underscore.
ESC (	1B 28	27 40	Not used.
ESC)	1B 29	27 41	Not used.
ESC *	1B 2A	27 42	Not used.
ESC +	1B 2B	27 43	Selects read only memory (ROM) table.
ESC –	1B 2D	27 45	Sets automatic underscore.
ESC .	1B 2E	27 46	Sets graphics mode (available with option board.
ESC /	1B 2F	27 47	Cancels graphics mode (available with option board).

Table A-1 NEC XX50 Command Set Control Codes and Escape Sequences (cont'd)

CONTROL CODE OR ESC SEQUENCE	CONTROL CHARACTER EQUIVALENTS HEX	DECIMAL	FUNCTION
ESC :	1B 3A	27 58	Performs one half-line feed.
ESC ;	1B 3B	27 59	Performs one half reverse line feed.
ESC <	1B 3C	27 60	Cancels SI and ESC SI.
ESC =	1B 3D	27 61	Clears line feed pitch and spacing pitch.
ESC >	1B 3E	27 62	Cancels ESC <.
ESC ?	1B 3F	27 63	Sets RAM table loading.
ESC @	1B 40	27 64	Clears RAM table loading.
ESC [	1B 5B	27 91	Clears auto return and line spacing.
ESC ^	1B 5E	27 94	Sets auto return and line spacing.
ESC #A	1B 23 41	27 35 65	Initializes the printer.
ESC #P	1B 23 50	27 35 80	Not used.
ESC $A	1B 24 41	27 36 65	Automatically centers text.
ESC $B	1B 24 42	27 36 66	Automatically justifies text.
ESC % (@ to –)	1B 25 (40 to 5F)	27 37 (64 to 95)	Offset selection.
ESC \A	1B 5C 41	27 92 65	Selects hopper 1.
ESC \B	1B 5C 42	27 92 66	Selects optional hopper 2.
ESC \E	1B 5C 45	27 92 69	Not used.
ESC \F	1B 5C 46	27 92 70	Not used.

Table A–1 NEC XX50 Command Set Control Codes and Escape Sequences (cont'd)

CONTROL CODE OR ESC SEQUENCE	CONTROL CHARACTER EQUIVALENTS HEX	DECIMAL	FUNCTION
ESC \J	1B 5C 4A	27 92 74	Not used.
ESC]# (@ to O)	1B 5D 23 (40 to 4F)	27 93 35 (64 to 79)	Defines HMI.
ESC ~a	1B 7E 61	27 126 97	Shift in.
ESC ~b	1B 7E 62	27 126 98	Shift out.
ESC ~z	1B 7E 7A	27 126 122	Cancels ESC ~a and ESC ~b.
ESC }a	1B 7D 61	27 125 97	Selects Character Set 1 (see Section 5).
ESC }b	1B 7D 62	27 125 98	Selects Character Set 2 (see Section 5).

Table A-2 is a quick reference to the 4201 IBM Proprinter control codes and escape sequences, their hex and decimal equivalents, and their functions. See Section 6 for an explanation of each code and sequence.

Table A-2 Proprinter Control Codes and Sequences

CONTROL CODE OR ESC SEQUENCE	CONTROL CHARACTER EQUIVALENTS HEX	DECIMAL	FUNCTION
NUL	00	00	Ignored by printer.
BEL	07	07	Sounds the buzzer.
BS	08	08	Moves the print position one character to the left.
HT	09	09	Advances the print position to the next preset horizontal tab.
LF	0A	10	Advances the print position to the next line.
VT	0B	11	Advances the print position to the next preset vertical tab.
FF	0C	12	Advances paper to next top-of-form and performs a carriage return.
CR	0D	13	Returns the print position to the left margin.
SO	0E	14	Sets elongated printing mode by line.
SI	0F	15	Sets condensed printing mode.
DC1	11	17	Sets printer up to accept data from the computer.
DC2	12	18	Sets 10 cpi printing mode.

Table A-2 Proprinter Control Codes and Sequences (cont'd)

CONTROL CODE OR ESC SEQUENCE	CONTROL CHARACTER EQUIVALENTS HEX	DECIMAL	FUNCTION
DC3	13	19	Ignored by printer.
DC4	14	20	Cancels elongated printing mode.
CAN	18	24	Cancels all data stored in the last print buffer.
SP	20	32	Moves print position one character space to the right.
ESC 0	1B 30	27 48	Sets line spacing at 8 lines per inch (lpi).
ESC 1	1B 31	27 49	Sets line spacing at 7/72 inch.
ESC 2	1B 32	27 50	Begins text line spacing stored by ESC A(n).
ESC 3(n)	1B 33(n)	27 51(n)	Sets line spacing at n/216 inch. The value of n ranges from 1 to 255.
ESC 4	1B 34	27 52	Sets top-of-form.
ESC 5(n)	1B 35(n)	27 53(n)	Selects or cancels automatic line feed. n=1 select n=0 cancel
ESC 6	1B 36	27 54	Selects Character Set 2 (see Section 6).
ESC 7	1B 37	27 55	Selects Character Set 1 (see Section 6).
ESC A(n)	1B 41(n)	27 65(n)	Stores a line spacing value of n/72 inch. The value of n ranges from 1 to 85.

Table A–2 Proprinter Control Codes and Sequences (cont'd)

CONTROL CODE OR ESC SEQUENCE	CONTROL CHARACTER EQUIVALENTS HEX	DECIMAL	FUNCTION
ESC B(n1)(n2)...(nk)NUL	1B 42(n1)(n2)...(nk)NUL	27 66(n1)(n2)...(nk)NUL	Sets vertical tabs. The value of n ranges from 1 to 255. Up to 64 vertical tabs can be set.
ESC C(n)	1B 43(n)	27 67(n)	Sets page length at n lines per page. The value of n ranges from 1 to 255.
ESC C NUL(n)	1B 43 00(n)	27 67 0(n)	Sets page length at n inches per page. The value of n ranges from 1 to 22.
ESC D(n1)(n2)	1B 44(n1)(n2)	27 68(n1)(n2)	Sets horizontal tabs. Up to
...(nk)NUL	...(nk)NUL	...(nk)NUL	28 horizontal tabs can be set.
ESC E	1B 45	27 69	Selects shadow printing.
ESC F	1B 46	27 70	Cancels shadow printing.
ESC G	1B 47	27 71	Selects bold printing.
ESC H	1B 48	27 72	Cancels bold printing.
ESC I(n)	1B 49(n)	27 73(n)	Selects font. n=0,2 selects standard font. n=4,6 selects download font.
ESC J(n)	1B 4A(n)	27 74(n)	Advances the print position n/216 inch. The value of n ranges from 1 to 255.
ESC K(n1)(n2) (v1)(v2) (v...)	1B 4B(n1)(n2) (v1)(v2) (v...)	27 75(n1)(n2) (v1)(v2) (v...)	Selects 480–bit graphics.
ESC L(n1)(n2) (v1)(v2) (v...)	1B 4C(n1)(n2) (v1)(v2) (v...)	27 76(n1)(n2) (v1)(v2) (v...)	Selects 960–bit graphics.

Table A–2 Proprinter Control Codes and Sequences (cont'd)

CONTROL CODE OR ESC SEQUENCE	CONTROL CHARACTER EQUIVALENTS HEX	DECIMAL	FUNCTION
ESC N(n)	1B 4E(n)	27 78(n)	Selects automatic perforation skip. The value of n indicates the number of lines to be skipped and ranges from 1 to 255.
ESC O	1B 4F	27 79	Cancels automatic perforation skip.
ESC Q(3)	1B 51(3)	27 81(3)	Deselects printer.
ESC R	1B 52	27 82	Sets all tabs to power–on default settings. Horizontal tabs are set at every 8 positions starting at column 9, and all vertical tabs are cleared.
ESC S(n)	1B 53(n)	27 83(n)	Selects subscripts or superscripts. n=1 subscripts n=0 superscripts
ESC T	1B 54	27 84	Cancels subscripts or superscripts.
ESC W(n)	1B 57(n)	27 87(n)	Selects or cancels elongated printing. n=1 selects n=0 cancels
ESC Y(n1)(n2)	1B 59(n1)(n2)	27 89(n1)(n2)	Selects 960–bit graphics
(v1)(v2)	(v1)(v2)	(v1)(v2)	(same as ESC L).
(v...)	(v...)	(v...)	
ESC Z(n1)(n2) (v1)(v2) (v...)	1B 5A(n1)(n2) (v1)(v2) (v...)	27 90(n1)(n2) (v1)(v2) (v...)	Selects 1920–bit graphics.

Table A-2 Proprinter Control Codes and Sequences (cont'd)

CONTROL CODE OR ESC SEQUENCE	CONTROL CHARACTER EQUIVALENTS		FUNCTION
	HEX	DECIMAL	
ESC -(n)	1B 2D(n)	27 45(n)	Selects or cancels continuous underscore. n=1 select n=0 cancel
ESC :	1B 3A	27 58	Selects 12 cpi printing.
ESC =	1B 3D	27 61	Downloads character font image.
ESC \(n1)(n2)	1B 5C (n1)(n2)	27 92 (n1)(n2)	Selects continuous printing from the All Characters chart (see Table 6-3).
ESC ^	1B 9E	27 94	Prints one character from the All Characters chart (see Table 6-3).
ESC (n)	1B 5F(n)	27 95(n)	Selects or cancels continuous overscore. n=1 selects n=0 cancels

Table A–3 is a quick reference to the FS sequences, their hex and decimal equivalents, and their functions. See Section 7 for an explanation of each sequence.

Table A–3 FS Sequences

	CONTROL CHARACTER EQUIVALENTS		
FS SEQUENCE	HEX	DECIMAL	FUNCTION
FS 0<00>(α)	1C 30 <00>(α)	28 48 <00>(α)	Download character selection mode. α=a set α=z clear
FS 1<n11 n12>...	1C 31<n11 n12>...	28 49<n11 n12>...	Ruled line setting.
FS 2(α)	1C 32(α)	28 50(α)	Form registration mode. α=a start α=b end α=z cancel
FS 4(α)	1C 34(α)	28 52(α)	Form information reference. α=a set α=z clear
FS 5(α)(β)...	1C 35(α) (β)...	28 53(α) (β)...	8–bit dot vertical and horizontal density.
FS 6(α)(β)...	1C 36(α) (β)...	28 54(α) (β)...	8–bit dot repeat vertical and horizontal density.
FS 7(α)(β)...	1C 37(α) (β)...	28 55(α) (β)...	16–bit dot vertical and horizontal density.
FS 8(α)(β)...	1C 38(α) (β)...	28 56(α) (β)...	16–bit dot repeat vertical and horizontal density.
FS 9(α)(β)...	1C 39(α) (β)...	28 57(α) (β)...	Raster graphics end positioning.
FS C(α)	1C 43(α)	28 67(α)	Selects the command set. α=a IBM Proprinter α=z NEC XX50

Table A–3 FS Sequences (cont'd)

	CONTROL CHARACTER EQUIVALENTS		
FS SEQUENCE	HEX	DECIMAL	FUNCTION
FS E(n)	1C 45(n)	28 69(n)	Sets VMI at n/300 in.
FS F(n)	1C 46(n)	28 70(n)	Sets HMI at n/300 in.
FS H(α)	1C 48(α)	28 72(α)	Control paper-size error alarm.
FS R(α)	1C 52(α)	28 82(α)	Selects the international character sets. α=a USA α=b France α=c Germany α=d United Kingdom α=e Denmark α=f Sweden α=g Italy α=h Spain α=i Japan α=j Norway α=k Denmark II α=l Netherlands
FS !(α)	1C 21(α)	28 33(α)	Selects subscript or superscript. α=a subscript α=b superscript α=z clear
FS "(α) <$\beta_1\beta_2$>	1C 22(α) <$\beta_1\beta_2$>	28 34(α) <$\beta_1\beta_2$>	Sets top margin. α=a HMI α=b inches
FS #(α) <$\beta_1\beta_2$>	1C 23(α) <$\beta_1\beta_2$>	28 35(α) <$\beta_1\beta_2$>	Sets text length. α=a HMI α=b inches
FS $	1C 24	28 36	Clears top margin and text length.

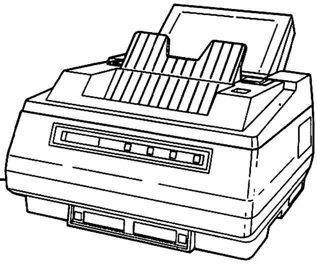
Table A–3 FS Sequences (cont'd)

FS SEQUENCE	CONTROL CHARACTER EQUIVALENTS		FUNCTION
	HEX	DECIMAL	
FS %(α)	1C 25(α)	28 37(α)	Perforation skip. α=a set α=z clear
FS &(α) <m11 m12> <n12 n12>	1C 26(α) <m11 m12> <n12 n12>	28 38(α) <m12 m12> <n12 n12>	Horizontal cursor positioning. α=a moves cursor to the right from initial position. α=b moves cursor to the left from initial position. α=c moves cursor to the right from current position. α=d moves cursor to the left from current position.
FS '(α) <m12 m12> <n12 n12>	1C 27(α) <m12 m12> <n12 n12>	28 39(α) <m12 m12> <n12 n12>	Vertical cursor positioning. α=a moves cursor down from initial position. α=b moves cursor up from initial position. α=c moves cursor down from current position. α=d moves cursor up from current position.
FS (<n1 n2>	1C 28 <n1 n2>	28 40 <n1 n2>	Selects number of copies.
FS) <m1 m2> <n1 n2>	1C 29 <m1 m2> <n1 n2>	28 41 <m1 m2> <n1 n2>	Font selection.
FS *(α)	1C 2A(α)	28 42(α)	Manual feed mode. α=a select manual feed mode α=b select first hopper α=c select second hopper α=d return to previous mode

Table A–3 FS Sequences (cont'd)

FS SEQUENCE	CONTROL CHARACTER EQUIVALENTS HEX	DECIMAL	FUNCTION
FS +(α)	1C 2B(α)	28 43(α)	Elongation mode. α=a vertical elongation α=b horizontal elongation α=c square elongation α=z clear
FS ,(α)	1C 2C(α)	28 44(α)	Screen (dot mesh) printing. α=a select pattern 1 α=b select pattern 2 α=c select pattern 3 α=d select pattern 4 α=z clear
FS –(α)	1C 2D(α)	28 45(α)	Reverse (white on black) print. α=a set α=z clear
FS .(α)	1C 2E(α)	28 46(α)	Printer test. α=a set α=z clear
FS /<00>...	1C 2F<00>...	28 47<00>...	Download character set.
FS ;(α)	1C 3B(α)	28 59(α)	Download registration mode.
FS :(α)(β)...	1C 40(α) (β)...	28 58(α) (β)...	Raster graphics transfer.

Appendix B



Specifications

Print Speed

8 pages per minute (letter)
6 pages per minutes (legal)
Maximum 2–minute warm–up
20 seconds for first printout (hopper)
22 seconds for first printout (manual feed)

Print Method

Electrophotography, LED array (fixed head, single row)

Disposable cartridges
- Toner – Replace after 3,000 pages.
- PC – Replace after 7,000 pages.

Resolution

300 x 300 dots per inch

Resident Fonts

Courier 10 pitch (Portrait)
Courier 12 pitch (Landscape)
Courier Italic 10 pitch (Portrait)
Courier Symbol 10 pitch (Portrait)

Paper Size

Letter
Legal
A4
B5

Paper Weight

16 to 24 lb

Paper Loading Methods

Automatic

- 250-sheet-capacity hopper
- Optional 250-sheet-capacity second hopper

Manual

- 1 sheet input/output manual feed slot

Paper Stacking Methods

250-sheet-capacity face-down bin
Optional 25-sheet face-up tray

Switch-Selectable Interface

IBM - standard parallel, Centronics® parallel, and RS-232C

Page Memory

128 KB consisting of a code buffer, dot image buffer, download character buffer, form buffer, and firmware work area (16 KB)

Character Spacing

10 cpi, 12 cpi
17 cpi (condensed)
Proportional spacing
n/300 in.

Line Spacing

1, 2, 3, 4, 6, 8, 12, 25, 50 lines per inch (lpi)
n/300 in.

Power Requirements

115 Vac ± 10 Vac
60 Hz ± 1 Hz

230 Vac ± 15%
50/60 Hz ± 1 Hz

Power Consumption: 0.8 KW (maximum)

Operating Temperature

50° F to 95° F (10° C to 35° C)

Storage Temperature

23° F to 140° F (–5° C to 60° C)

Dimensions

Width – 18.5 in. (470 mm)
Depth – 20.7 in. (525 mm)
Height – 10.9 in. (276 mm)
Weight– 65 lb. (29.4 kg)

Noise Level

Operating – 52 dBA
Idle – 45 dBA

Administrative Compliance

UL 478 EDP
CSA C22.2
FCC Class B
VDE 0871/0806
IEC 380

Glossary

ACKNLG Acknowledgement that a transmission has been received or that the receiver is ready to accept the next transmission.

ASCII American Standard Code for Information Interchange; this standard defines character set codes that are used for data interchange between data terminal equipment. This code defines 96 displayed characters (64 without lowercase) and 32 nondisplayed control codes in terms of 7 bits plus an eighth bit for parity check.

baud The rate of data transmission, measured in bits per second.

BEL Bell command. Sounds the printer's buzzer.

BS Backspace command. Moves the print position one space to the left.

buffer An electronic memory where text is stored for processing by the printer.

CAN Cancel command. Cancels data printing back to the last return.

condensed printing 17 pitch printing.

control code A nonprintable ASCII code that is used to control a printer function.

cpi Characters per inch. Also known as pitch.

DEL Delete command. Deletes data printing back to the last return.

deselected A mode in which the printer cannot receive data from the host computer.

double-strike printing A way of printing boldface characters. Each character is printed once, then the paper is shifted up 1/180-inch, and the character is printed again.

download character User–defined character that can be loaded from the host computer to the printer.

elongated printing Double–width printing of characters.

ESC Escape sequence. A combination of codes (with ESC as the first code) used in programming printer functions.

FF Form feed command. Advances the paper one page length.

font cartridge An optional cartridge inserted into one of the slots on the front of the printer to add additional fonts or type styles to the printer's resident fonts.

FS Form separator sequence. A combination of codes (with FS as the first code) used to program printer parameters.

HMI Horizontal motion index. The amount of horizontal paper movement after a character is printed.

HT Horizontal tab command. Advances the paper to the next preset horizontal tab.

initialization A state where all settings return to their default values.

justification The arrangement of printed text on a page where the left and right end characters of each line lie in the same respective column.

LF Line feed command. Advances the paper one line.

lpi Lines per inch.

MTBF Mean Time Between Failures.

MTTR Mean Time To Repair.

parity bit The bit added to each group of bits sent to make the group always odd or always even. Used to detect errors in the printer and host communication.

pitch The number of characters per inch in a line.

program mode A proportional spacing mode set by the host computer.

PS Proportional spacing. A printing method in which the distance between characters varies according to the width of the characters.

RAM Random access memory. An electronic memory that can be written to and read from.

ROM Read only memory. An electronic memory that can only be read from.

selected A mode in which the printer can receive data from the host computer.

shadow printing A style of printing where each character is printed once, then the paper is shifted two dots to the right and the character is printed again.

spacing offset The amount of space that separates printed characters.

VMI Vertical motion index. The amount of vertical paper movement between printed lines.

VT Vertical tab command. Advances the paper to the next preset vertical tab.

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